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THE HOST-PARASITE RELATIONSHIP IN AMOEBIASIS*

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An understanding of the relationship between *Entamoeba histolytica* and man implies an appreciation of many factors in host-parasite relationship, and some understanding of the whole question of association between members of different species.

Since the beginning of time living things have been constantly in contact with other living things, either of their own or some other species, and it is not surprising that over the course of aeons some of the associations have become permanent and obligatory. In some cases they have become so close that it is almost impossible to distinguish one partner from the other. The progress has been taken by steps so infinitesimal that it appears to have been continuous, but it has been evolutionary and associated with modifications of habit and of structure just as in evolution generally.

Some species associate regularly with their own kind—man for example is a gregarious animal—others associate with species other than their own. A well-known example is the herding together of zebra and wildebeest, that one may see in the game reserve, but there are many others. It may be that zebra and wildebeest merely like the same food and country, but there might be a more romantic reason—such as mutual protection. A wander along our coasts will reveal many examples of association between different species. Sometimes, this is mere inquilinism—a sharing of the same home—and such close association may give rise to malpraxis and dichotomy. The hermit crab uses a mollusc shell as a home—a home which may be disguised by sea anemones. The crab has no objection and the anemones gain by the additional mobility. Some crabs have taken advantage of the poisonous nature of the anemone and use them to stun fish, making them easier to capture.

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It is not all one way, for the crab may find that he has a lodger in the shell in the form of a nereid worm which, while it does not attack the crab, steals the food from between its very jaws.

Invasion of the bowel

It is no great step from such association to invasion of the intestine; a pioneering adventure which undoubtedly first took place by chance, but one of which the newcomer was quick to take advantage. He soon realized the delights of a plentiful supply of food and a controlled environment. Adaptation soon followed, even though it imposed the difficulty of getting from one host to the next. Such parasites, many of whom are only parasitic in that they live inside another species do but little or no harm to the host—and as you well know—the host may take advantage of their presence and make use of their metabolism. From such mutual advantage arose the phenomenon known as symbiosis, which in some pairs of species has developed to the extent that neither can do without the other. An interesting example, of local importance, is the association between *Cryptotermes brevis* and its intestinal protozoa. *Cryptotermes*, though it eats the woodwork of our homes, cannot digest cellulose and for this process is dependent upon the micro-organisms in its bowel. If these are somehow destroyed the termite will starve. Larval termites are fed with faeces by the adults in order to set this process in action. Man and other animals too are very dependent on their intestinal inhabitants for such processes as the bile cycle and vitamin-B synthesis. Despite our aesthetic objection to such invaders we cannot do without them.

Some invaders, however, make no evident contribution to the general good and, though most are merely robbers of food, some have so transgressed the rules of hospitality as to invade their hosts further. This invasion may be minimal, as exemplified by the tapeworm, whose attack is confined to its anchor in the turbulent environment in which it lives.

That invasion may go a trace further without much damage to the host is exemplified by *Trichocephalus*, which usually does not make itself felt until there are thousands of worms. The next phase may be illustrated by the hookworms, whose habit of nibbling the mucosa may lead to a loss of blood which, taken the world over, has been estimated at some 500 tons a day, but with which the average individual can cope by adequate nutrition.

Invasion of the blood stream

Parasites can and do go further. The bilharzial worms have found that the portal vein—that *cloaca maxima*—provides even better accommodation. The adults, while alive, do not appear to do much damage, and the haemorrhage caused by the passage of the eggs is but slight. The main damage done by such a parasite follows sensitization and over-response of the host and, though cases may appear numerous, this occurs in but a small proportion of cases of a widespread condition.

Parasites by their mode of life have been able to dispense with organs and processes which would be necessary for an independent existence. Perhaps the most extreme example is illustrated by *Sacculina* in the crab. This copepod, in its adult stage, has discarded all its organs except those of sex and depends on its host for everything, including its hormones.

On the other hand, adoption of a parasitic existence has not been without its complications. Passage from one host to the next may require most involved processes and may necessitate the use of one or more intermediate hosts. For example, *Diphyllobothrium latum*, the broad tapeworm, passes first through Cyclops and then through fish until it reaches its final host. The development of so complex a cycle illustrates not only the devious routes by which some parasites attain their ultimate host, but also two other points: Such a process must have taken a very long time to evolve and, equally, it must be very easily deranged.

Malaria, that parasite most destructive of man, probably started out as a parasite of the insect gut. Other sporozoa, such as the *Isoospora*, which also affect man, have remained as gut inhabitants. When, however, the mosquito took to blood-sucking, the malaria parasite was quick to adopt this as a means of transmission from one mosquito to the next. The adoption of an asexual phase in the new host greatly increased the chances of transmission to the definitive host. If we argue by analogy from other haematozoa, and take into consideration our new knowledge of the liver cycles, it seems possible that the phase of schizogony in the red cells is a new development, an experiment in evolution by the parasite for which the intermediate host is the primary sufferer, and for which the parasite itself would suffer in due course by the destruction of its intermediate host.

Host-parasite equilibrium

As a general rule, it does the parasite no good to destroy a host. A plentiful supply of hosts is to the advantage of the parasite and, in fact, he cannot survive without them. The only exception to the general rule is where the second host is a predator of the first. *Muticeps muticeps*, which causes giddiness in sheep, presumably makes its victim more easily caught and eaten by the next host—the dog. *Trichinella*

spiralis is a parasite which may make its host ill, but this is usually during the phase of invasion, during which the parasite is non-infective. It must be remembered that man is not the usual host of *T. spiralis*, which is, fundamentally, a parasite of rats. The little spiral we see encysted in the muscle is a parasite prepared to wait for its present host to die and be eaten by the next host, which is usually another rat. Thus it is a disease of cannibals. If, perchance, the dead rat is eaten by an unusual host, such as a pig, the parasite will repeat its life-cycle, in host after host, presumably hoping some time to meet its true host once again. Other parasites are prepared to repeat a larval phase in host after host on the off-chance of some day meeting a host suitable for the adult phase.

Thus the process of parasitism has been a long one, with a series of adaptations by both parasite and host. Each evolutionary essay by the parasite has been countered by a corresponding change in the host. Where the experiment in evolution has been too drastic, the host has died out together with its venturesome parasite. Where the change has been acceptable to the host, the process and the parasite have continued. Thus there has been a process of 'give and take' which over the millenia has for the most part reached a state of equilibrium.

Therefore we must look at parasites in a slightly different light. They are so dependent on their host that they must be gentle in their attack—where they are not, there is some aberration or variation from normality, the cause of which we must find.

Habits and Hygiene

Normality in the relationship between host and parasite should really be considered as the primitive state. Man has changed his own habits considerably, and this change of habit has affected also his parasites. The change from a nomadic to an agricultural life must have affected their chances of survival. The cultivation of the land, especially where there is fertilization by faeces, gave some parasites an easier passage from host to host. Where previously the parasite had to produce enormous numbers of offspring to have any hope of finding another host, now those enormous numbers readily find hosts, and in numbers to which those hosts had not been accustomed. The advent of hygiene must have been a considerable blow to the parasite world, and one which if fully adopted would mean the end of many species parasitic in man. It might well also eliminate those helpful parasites on which we depend and which we all gain originally by some more or less remote degree of coprophagy. Ultimately we too, like the termites, may have to feed our young with faeces to initiate such processes as the bile cycle and the like.

Where, in cave-man days, the probability of acquiring a parasite from outside one's home circle was small, with modern crowding it is not surprising that parasites pass more easily from one human to another. Parasitism has even developed within the human species. Where there is crowding without hygiene, the parasite population will build up to a degree never attained in the primitive state—a degree upsetting the host-parasite balance. Man's closer association with his animals has meant, too, that interchange of parasites is taking place—often involving new manifestations.

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AMOEBIASIS

The picture is, therefore, by no means simple and, when we come to a parasite such as *E. histolytica*, it becomes more and more complex, a muddle further complicated by our lack of knowledge. It is a horrible reflection that there has been so little advance since the original paper by Lösch¹—a paper which all students of the subject should read, not only as an example of meticulous study, but also to impress on us just how little has been done since 1875.

Our first failure with *E. histolytica* has been in its recognition. When one is dealing with an object as flexible as an amoeba it is not surprising that taxonomy is difficult. Add to this the fact that it does not grow readily in culture—alone, practically never—and we are denied the biochemical approach made by the bacteriologist. We have failed, too, in our appreciation of the pathology—and pathogenicity of the parasite—a failure accentuated by our failure to treat and to prevent the disease process.

Let us examine the evidence available on the parasite. Amoebae called *E. histolytica* have been found in practically all parts of the world and, though the disease is generally considered 'tropical', the first adequately described case occurred in St. Petersburg—60°N. The variation in incidence of the parasite in different parts of the world is enormous, but the variation in incidence of disease associated with the parasite is even greater and the two do not by any means run parallel.

The apparent variation in incidence in different parts of the world can be attributed in part to the varying ability of the observers. There is no parasite more often misdiagnosed than is *E. histolytica*. It is neither easy to find nor easy to identify, and it has been said² that 'in the diagnosis of *E. histolytica* the enthusiasm of the uninitiated is only to be matched by the scepticism and caution of the expert'. One has seen so many things labelled as *E. histolytica* which have but slight resemblance to the parasite, that one finds there are but few acceptable observations of incidence on record.

The variation in incidence of disease due to the parasite comes under criticism. So many conditions have been attributed to infection with the parasite that the picture is completely confused. It has been said that pregnancy is the only condition for which the amoeba has not been blamed. When, however, one takes such acceptable manifestations as true dysentery and liver abscess the variation in disease incidence takes on a better perspective. Except under unusual circumstances the disease could be labelled 'tropical', for in truly temperate zones frank manifestation is uncommon. When, however, we relate the distribution of the parasite to the distribution of the disease it becomes evident that there are additional factors involved.

For Great Britain, Hoare³ states that of the resident population about 10% are carriers of *E. histolytica*. This seems an enormous figure but, were the figure only 1%, there should be manifest disease in the population if the parasite is always pathogenic. Such cases could not escape recognition in a country so well served medically as Great Britain. However, when such cases do occur they merit report in the medical press. By contrast take our city of Durban, where various populations show an incidence varying from 5% to 20%, the disease is common and, in

the African, appears in a florid form in which there can be no doubt of the association between the parasite and the disease.

Our assessment of the disease must take all the factors into consideration. Is there more than one strain of *E. histolytica* involved? Is there perhaps an organism we are labelling as *E. histolytica* which is not pathogenic? Are these strains of *E. histolytica* interchangeable? Is the incidence of disease a question of massive infection? What is the effect of climate, of diet, and possibly of other organisms in the bowel such as bacteria and other parasites.

Two forms of Entamoeba histolytica

The identity of *E. histolytica* is still by no means clear. Despite study by numerous observers over the course of some 60 years, there is still considerable doubt about the exact characteristics of this parasite. A current opinion suggests that *E. histolytica* may exist in two forms: a large pathogenic and a smaller commensal, the latter being the 'minuta' form of Hoare⁴ and possibly the *E. dispar* of Brumpt.⁵ Another species of amoeba, *E. hartmanni*, is morphologically indistinguishable from the commensal form of *E. histolytica*. All these three parasites are currently reported as *E. histolytica*, for there is no practicable way of telling one from another.

As the large race of *E. histolytica* seldom produces cysts, it is difficult to conceive how infection with this particular form can be passed from one man to another and, therefore, the next point of confusion arises. Is there any switch from the so-called small form to the large form or *vice versa* under some change of environment? It must be remembered that *E. histolytica* is absolutely dependent for its supplies of some enzyme system on the presence of other organisms. It has so far proved impracticable to grow *E. histolytica* in the test tube without some other concomitant organisms. In the bowel there are plenty of bacteria available, in the liver presumably man supplies the missing enzyme system.

This means of course that *E. histolytica* is singularly susceptible to its environment, and one will need to examine *E. histolytica* under many varying conditions. In the culture of *E. histolytica* from the stool one is always confronted by the fact that there is a mixed bacterial flora present. However, by various manoeuvres it is possible to reduce the number of organisms in our mixed cultures and even, on occasion, to re-establish the amoeba with but a single concomitant organism. We have achieved this in the past by micromanipulation, that is to say, by picking up the amoeba and washing it free of bacteria which, as you can imagine, is a pretty tedious procedure. Lately we have been isolating the amoebae directly from liver abscesses where there are no extraneous organisms. We have been able to grow such amoebae alone with *Clostridium welchii*, and also with an organism known as the *Streptobacillus* of Frye. We have also been able to pass the amoebae through several passages in minced chicken embryo which of course contains living cells. By this means we are able to vary the flora to a certain extent. The whole process is fraught with frustration but, so far, one or two interesting observations have been made.

We do know that *E. histolytica* does not encyst in the tissues. It was at one time postulated that *E. histolytica* might, by embarking on an invasive stage, be giving up all chance of posterity. One of our early experiments was to see whether such large amoebae could be made to encyst in culture.

Operating from stool material was always difficult because one could never be sure that there was but a single strain of amoebae in the culture. However, by utilizing material from liver abscesses, we were able to start monoxenic strains and we find that by changing the flora of the cultures we have been able to induce the invasive amoeba to form cysts. So it would appear that the change is not irreversible. Further, when these amoebae from the liver were initially isolated they were large and fat, and remained so as long as they stayed with *Clostridium welchii* but when they were switched to a stool flora previously associated with an encysting amoeba they then not only formed cysts but became considerably smaller. It would seem, therefore, that it is not unlikely that the invasive commensal forms of histolytica are variations brought about by some environmental factor. Just what that environmental factor is we do not know.

Commensal or invasive

What is the application of this concept to the epidemiology of the disease? It would appear that *E. histolytica* can live in the human bowel without causing any disturbance. Here it lives as a pure commensal, feeding on bacteria and debris and not in any way harming the host. It is this phase which

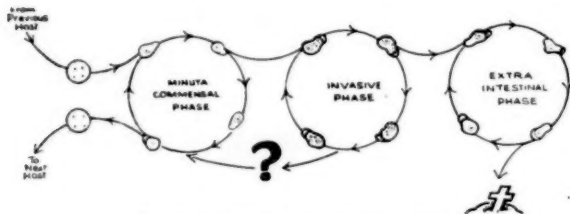


Fig. 1. Cycle of *Entamoeba histolytica*.

produces the cysts that carry the parasite from one host to the next. Under some unknown stimulus the amoeba invades the tissues, becoming larger and haematophagous and at this stage causing disease. It would seem that the differences between the manifestations in the tropics and sub-tropics on the one hand and in the truly temperate zones on the other are due to this environmental factor. What do we know of this environmental factor?

Durban itself forms a microcosm, in that in this one city we have the various manifestations of this parasite. The Whites commonly show the picture of *E. histolytica* found outside of the tropics; the Africans, on the contrary, show a fulminant dangerous disease. The obvious solution to the problem lay in the question of diet, but even this was confused because we have shown that where experimental animals are fed on diets in which the carbohydrate is supplied by wheat, rice and maize, the animals most affected were those on a wheaten diet. However, study of the epidemiology of the cases in Durban indicates that it is the African eating a purified wheaten diet and largely confining himself to such a diet who provides the large majority of cases. It was in this connection that we coined the phrase, 'the bun and lemonade diet'. It would seem that the confining of a diet to purified

carbohydrate is dangerous in this respect, for it must be obvious that there are protective elements in the remainder of the White diet.

A further clue has been provided by our remarkable success in the treatment of the acute disease by the use of a wide anti-bacterial attack. By changing the flora of the bowel we are able to profoundly modify the condition and in a high proportion of cases to eliminate the parasite as well as to cure the disease. It would appear, therefore, that such change as is originated by incorrect diet is mediated by the bacteria of the bowel.

This is the position as we see it at the moment; there are many questions yet to be answered and much work yet to be done. In conclusion, we can only hope that our probings will lead to a better appreciation of the relationship between amoeba and man—and a recognition of ways to re-establish the conditions under which they may live in complete harmony.

SUMMARY

Parasitism is but an extreme development of the association between two animals, and all shades of such association are to be found, ranging from casual acquaintance to an intimacy so close as to be all but identity.

Though this association may be close, it does not imply that one member is harming the other, and indeed there may be mutual benefit. There are once again all grades ranging from indifference to vicious attack.

Theoretically there are few cases where it is to a parasite's advantage to destroy its host. It is true that some parasites—usually vegetable in character—seem to have no thought for posterity, but the higher up the development scale the greater is the respect of the parasite for his source of food and warmth.

Most parasites reach an equilibrium with their hosts, the parasites renouncing further territorial claims in exchange for the tolerance of the host, and the host accepting the demands of the parasite up to a limit. Such an equilibrium may be upset in many ways—for example, by an overload of parasites, or by some deviation from the fundamental cycle of the parasite.

The relationship between man and *E. histolytica* is by no means simple. There are many confusing factors, and opinions reach to extremes. Proofs remain to be found and many questions remain to be answered. Is *E. histolytica* always pathogenic? Is there more than one organism currently called *E. histolytica* in the human bowel? If *E. histolytica* is not always pathogenic, what determines its invasiveness?

These are but a few of the fundamental questions and there are others. Durban affords a suitable place for investigation of this problem, for the three races respond to infection in differing ways. The work done is discussed and future programmes outlined.

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South African Medical Journal

VAN DIE REDAKSIE

EDITORIAL

TERAPEUTIESE VRUGAFDRYING EN RUBELLA

Dit is reeds 'n paar jaar lank bekend dat die virus van rubella ernstige skade aan die ongebore vrug kan berokken, veral as die moeder binne die eerste drie maande van haar swangerskap Duitse masels kry. Vandag weet ons dat 'n hele paar afwykings in die aangetaste baba aan hierdie oorsaak gewyt kan word. Een van die algemeenste van hierdie gebreke, en inderdaad die eerste een wat beskrywe is, is aangebore blindheid, en sedert hierdie verskynsel deur Gregg¹ onder die aandag van die beroep gebring was, is dit bevind dat ander defekte ook veroorsaak word deur die beskadigende uitwerking van die rubella-virus op die ontwikkelende vrug.²

Hierdie verslae het by die verwagte moeder die vrees gewek dat 'n gebrekkige kind gebore mag word, en as gevolg hiervan het daar 'n sterk neiging ontstaan om aan te beveel dat terapeutiese afdrywing uitgevoer word op vroue wat gedurende hul swangerskap aan Duitse masels gely het, veral as die siekte binne die eerste drie maande voorgekom het. 'n Hele paar van hierdie terapeutiese afdrywings is uitgevoer. Onlangs is daar egter 'n noukeuriger studie gemaak van die voorkomssyfer van fetale misvorming volgend op rubella gedurende die swangerskap, en dit is bevind dat misvorming glad nie onvermydelik op so 'n siekte volg nie; die voorkomssyfer van gebreke weens hierdie oorsaak is, intendeel, maar gering. In 'n onlangse ondersoek insake die voorkomssyfer van hierdie kondisies, het Greenberg *et al.*³ heelwat moeilikheid ondervind om akkurate gegewens in te samel. Hulle het die voorkomssyfer by 104 vroue wat in die eerste trimester van hul swangerskap Duitse masels gekry het, bereken. Uit die 104 vroue was daar drie wie se babas liggaamlike gebreke getoon het. Uit die res het 28 moeders die lewe geskenk aan normale babas; 3 se babas is doodgebore; 15 s'n was nie lewensvatbaar nie; 48 moeders het terapeutiese vrugafdrywing ondergaan; en 10 moeders kon nie opgespoor word nie. Die ondersoekers het opgesom dat 'die voorkomssyfer van aangebore afwykings onder die lewende babas gebore uit vroue wat in die eerste drie maande van swangerskap rubella gehad het, 9.7% was, en in 'n soortgelyke ondersoek elders van swanger vroue wat nie die siekte deurgemaak het nie, was die voorkomssyfer 7%'. Die outeurs meen dat die hoë voorkomssyfers wat deur vroeër skrywers aangegee is, gebaseer was op studies uitsluitlik van misvormde babas, en dat hulle nie rekening gehou het met die normale babas nie, wat dan ook nie in hul studies in aanmerking geneem was nie. Hulle het tot die slotsom gekom dat die ,deur die bank aanbeveel van terapeutiese afdrywing by vroue wat vroeg in hul swangerskap rubella gehad het, nie medies geregtig kan word nie'.

Totdat die resultate van veel meer uitgebreide en volledige navorsing beskikbaar is, sal 'n mens maar twyfel aan die soort raad om te gee, maar meisietjies moet sekerlik aan rubella blootgestel word op 'n jong ouderdom sodat die gevaar heeltemal vermy kan word.

THERAPEUTIC ABORTION AND RUBELLA

It has been known for some years that the virus of rubella is capable of causing serious damage to the foetus, especially if the mother contracts German measles in the first trimester of her pregnancy. A number of defects in the affected infant are now recognized as being due to this cause. One of the commonest of these defects, indeed the earliest described, is congenital blindness, and after this phenomenon had been brought to the notice of the profession by Gregg,¹ other defects were traced to the harmful effect of the rubella virus on the developing embryo.²

These reports have engendered a dread in the mother that a malformed child might be born, as a result of which there has been a strong tendency to recommend that a therapeutic abortion should be carried out on women whose pregnancy has been marked by an attack of rubella, particularly if the attack took place in the first 3 months, and not a few of these therapeutic evacuations have been performed. Recently, however, closer assessment has been made of the frequency with which foetal malformations follow rubella in pregnancy, and it has been found that, far from malformations being inevitable after such an attack, their frequency is not even high. In a recent investigation into the frequency of these conditions, Greenberg *et al.*³ have had great difficulty in obtaining exact figures. They have assessed the frequency in 104 women who contracted rubella in the first trimester. Of these, 3 babies were born with deformities. Of the remainder, 28 mothers gave birth to normal infants, 3 to stillbirths, and 15 to non-viable foetuses; 48 underwent therapeutic abortions; and 10 mothers were untraced. The investigators concluded that 'the incidence of congenital malformations among the live babies born of women with rubella during the first trimester of pregnancy was 9.7%, and in a similar study elsewhere of pregnant women who did not contract rubella the incidence was 7%'. The authors maintain that the high rates recorded by earlier authors were based on restrictive studies of malformed infants and did not take account of babies which were born normal and which were therefore not included in the study. They concluded, too, 'that blanket advocacy of therapeutic abortion in pregnant women who developed rubella during the early months of pregnancy is medically unjustified'.

Until the results of very much larger and more complete investigations are available, there must be a certain dubiety about what advice should be given, but there can be no doubt that young girls should be exposed to rubella at an early age, so as to avoid the risk entirely.

Vandag blyk dit nie regverdigbaar om by elke geval waar die swanger vrou gedurende die eerste 3 maande van swangerskap opgedoen het aan te beveel dat terapeutiese aborsie uitgevoer word nie. Aangesien die misvormings na verhouding by betreklik min babas vermag kan word, kan ons 'n meer konserwatiewe houding inneem; 'n ouerige eersbare moeder wie se hoop op nog 'n kind gering of twyfelagtig is, moet sekerlik die geleentheid kry om haar swangerskap te voltooi; en enige morele of godsdienstige besware teen terapeutiese afdrywing moet met die grootste agting bejeën word. 'n Belangrike faktor wat die dokter in sy keuse sal beïnvloed, is die gevaar dat die moeder 'n kommerkompleks kan ontwikkel—dit is 'n saak wat Abromowitz⁴ baie duidelik stel.

Omdat dit so moeilik is om 'n uitgebreide serie saam te stel—rubella in die eerste drie maande van swangerskap is seldsaam, en ons skrywers wat in die stad New York werk, waar dit 'n geproklameerde siekte is, kon slegs 104 gevalle oor 6 jaar opspoor—is dit heeltemal duidelik dat statistieke oor langer tydperke nodig is voordat 'n finale antwoord gegee kan word. Hierdie onderwerp is nou verwant aan 'n saak wat verlede jaar deur die redaksie in die *Tydskrif* bespreek is,⁵ nl. die rol van te veel vitamien A by die veroorsaak van aangebore afwykings en die aanvuur-aksie van kortisoön. Die soektog na die hulpfaktor by rubella moet nou voortgesit word want die betreklik lae voorkomssyfer van misvorming dui daarop dat die virus op sigself alleen nie die afwyking kan veroorsaak nie, maar wel deur 'n ander faktor gepotensieer word. Daar strek 'n wye gebied voor die navorser en die resultate word met groot belangstelling afgewag.

Intussen is dit voorgestel dat gamma-globulien in dosisse van 15 c.c. toegedien word aan swanger vroue wat Duitse masels het of wat daaraan blootgestel was, hopen dat die teenliggaampies in die gamma-globulien die vrug sal beskerm teen skade deur die virus. Gamma-globulien is in Suid-Afrika beskikbaar, maar dit is baie duur.

Today it does not appear justifiable to advise a therapeutic abortion in every case where a pregnant woman develops rubella in the first trimester. With the relatively small proportion of babies in whom malformations are likely to occur, we can adopt a more conservative attitude; for example, an elderly primipara with little or doubtful prospects of having another child must certainly be given the opportunity of going to full term; likewise any moral or religious objections to therapeutic abortion should be strongly respected. An important factor that will influence the doctor in his choice will be the risk that the mother may develop an anxiety state—a point well taken by Abromowitz.⁴

Because of the difficulty of obtaining a large series of cases—rubella in the first trimester of pregnant women is rare and our authors, working in New York City, where rubella is a notifiable disease, could only find 104 cases in 6 years—it is quite evident that statistics over longer periods will be required before a final answer can be given. The subject links up closely with a matter discussed in an Editorial⁵ in the *Journal* last year, viz. the role of overdosage of vitamin A in the production of congenital deformities, and the potentiating action of cortisone. The search for the ancillary factor in rubella must now continue because the relatively low incidence of malformations indicates that the virus alone is not enough to cause the condition but requires potentiating. A wide field is now open for research and the results will be awaited with interest.

In the meantime it has been suggested that gamma globulin in doses of 15 c.c. should be given to pregnant women who are suffering from rubella or have been exposed to this disease in the hope that the antibodies present in the gamma globulin will protect the foetus against harm by the virus. Gamma globulin is available in South Africa but is expensive.

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4. Abromowitz, L. J. (1957): *S. Afr. T. Geneesk.*, 31, 1.
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1. Gregg, N. McA. (1941): *Trans. Ophthal. Soc. Austral.*, 3, 35.
2. Aycock, W. L. en Ingalls, T. H. (1946): *Amer. J. Med. Sci.*, 212, 366.
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LEPTOSPIROSIS IN SOUTH AFRICA

THE OCCURRENCE OF CASES OF LEPTOSPIRAL MENINGO-ENCEPHALITIS ON THE WITWATERSRAND

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Leptospiral jaundice of human beings is a rare disease in South Africa. Buchanan,¹ who had had considerable experience in the study of this condition in Britain, systematically tested over 200 South African cases of jaundice for evidence of infection with *Leptospira icterohaemorrhagiae*, but found none. He also examined 231 rodents, including 212 black rats (*Rattus rattus*), 8 gerbils (*Tatera*) and 3 striped mice (*Rhabdomys pumilio*) captured in and around Johannesburg, and 8 brown rats (*Rattus norvegicus*) from Durban, but

detected no sign of leptospiral infection. He observed leptospirae in samples of stagnant water, but these produced no ill-effects in inoculated guinea pigs and were therefore presumed to be non-pathogenic.

A systematic study of the other leptospiral infections in animals in South Africa has not yet been carried out, but Malherbe and Kashula² have reported on the occurrence of leptospirosis in dogs in South Africa. They noted that dogs were frequently seen presenting the syndrome of

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Stuttgart disease, often associated with severe kidney damage, and this responded readily to treatment with penicillin. Leptospirae were isolated from the blood, urine and organ emulsions of sick dogs by inoculation into guinea pigs, and demonstrated by the dark-field examination technique. Six dogs which had shown clinical symptoms of leptospirosis were bled after recovery and their sera tested by complement fixation and agglutination lysis tests. One serum gave a positive reaction with *L. canicola* and 2 with *L. sejroe*. This paper² recorded for the first time that canine leptospirosis existed in the Union of South Africa. In the discussion which followed the presentation of this paper at the 48th Annual Conference of the South African Veterinary Medical Association on 19 August 1953, Dr. V. Cooper reported that Weil's disease had been diagnosed in 2 human beings in Cape Town and that Dr. J. F. Brownlie had encountered both *L. canicola* and *L. icterohaemorrhagiae* in dogs.

The prevalence of these infections and the serotypes of leptospirae occurring in this country, their animal hosts, and their importance in causing human disease, have not yet been clearly defined. It thus will be of some interest to report the findings in 5 cases of meningo-encephalitis which on serological findings were proved to be due to leptospiral infections.

These serological tests were carried out as part of a wider programme to elucidate the causes of meningo-encephalitis and the aseptic meningitis syndrome in this region.

SEROLOGICAL METHODS

The serological tests used in this investigation for the detection of leptospiral antibodies were the complement-fixation and agglutination tests.

Preparation of Antigen. The antigens for the complement-fixation tests were prepared from egg cultures after it was found that antigens prepared from cultures in Fletcher's and Korthof's media were anticomplementary. To establish the infection, embryonated eggs were inoculated with 0.3-0.5 c.c. amounts of infected culture fluid, directly into the allantoic and amniotic sacs by means of the window technique. In the early subcultures, the eggs showed variation in the growths of leptospira obtained, but once established the growths became consistent and profuse.

The procedure then followed in preparing antigen was as follows: After 7 days primary incubation, the eggs were candled and the non-fertile and dead eggs were discarded. The living eggs were inoculated through a hole punched in the blunt end directly into the allantoic cavity each with 0.01-0.1 c.c. of heavily infected allantoic fluid derived from the previous subculture. These eggs were incubated for 7 days at 37°C. They were then candled again. The dead eggs were discarded, the eggs with living embryos were opened by burning a ring round the shell at the blunt end just above the shell membrane and flicking off the top. The shell membrane was reflected and the allantoic fluid aspirated with a syringe. The profuseness of growth was checked by examining the fluid under dark-ground illumination. If this was sufficiently rich the fluid was centrifuged at about 1,000 r.p.m. for 10 minutes to sediment the red cells. The supernatant was drawn off and heated at 60°C for 5 minutes. Merthiolate was then added to give a final concentration of 1:10,000. This fluid now constituted the antigen, which was kept at 4°C. Occasionally precipitates of urates formed, but this could be avoided by diluting the fluid in an equal volume of veronal buffer saline of pH 7.2.

Preparation of Antisera. Control antisera were prepared by inoculating rabbits at 6-day intervals with 0.3, 0.5, 0.75, and 1.0 c.c. of live cultures of the leptospira. One week after the last inoculation the rabbits were bled aseptically. The serum was separated from the clot and stored in a deep freeze at about -18°C.

Titration of Antigens. The antigens were titrated by the 'box' method to determine their strength. One example of the results obtained with *L. canicola* antigen in such a titration is given, as follows:

Antigen dilution	Antiserum dilution						Controls	
	1:25	1:50	1:100	1:200	1:400	1:800	Serum dilution 1:10	Saline
1:2	+	+	+	+	+	+	—	—
1:4	+	+	+	+	+	+	—	—
1:8	+	+	+	+	+	+	—	—
1:16	—	—	—	—	—	—	—	—

One antigen dose was taken as being contained in a dilution of 1:8, the highest dilution which gave clear-cut positive reaction in high titre against 2 full doses of complement. As 2 full doses of antigen were used, this was diluted 1:4 for the test.

The Complement-fixation Test Proper. The diluent used throughout was veronal buffer saline of pH 7.2.

Before dilution the sera were heated to 60°C for 20 minutes. In the preliminary screening the sera were tested in a dilution of 1:5 against each antigen. Two full minimum haemolytic doses (m.h.d.) of complement determined in the presence of the antigens individually by the overnight fixation method were added to each mixture. The haemolytic system consisted of a 1.5% suspension of washed sheep cells sensitized with 2 m.h.d. of haemolysin. The volumes used in the test were respectively

- 0.1 c.c. diluted serum
- 0.1 c.c. complement diluted to contain 2 full m.h.d.
- 0.1 c.c. diluted antigen
- 0.2 c.c. 1.5% sensitized sheep cells.

The fixation period allowed was 18-20 hours at 4°C. The tubes were then warmed in a 37°C water bath for 10 minutes before the addition of the sensitized cells. The racks were then thoroughly shaken and incubated for a further 30 minutes. The results were then read. The titre of complement fixation of all sera giving a positive reaction in this screening test was then determined.

The results given in this series of cases are noted in the individual cases. These were confirmed in the leptospiral agglutination test, with antigens prepared from cultures in Fletcher's medium. The identity of the antigens used was checked in comparative tests with antigens prepared from cultures recently received from Dr. Broom of the Wellcome Medical Research Foundation.

CLINICAL AND LABORATORY FINDINGS

Case 1

This patient, S.G.G. aged 25, a post-office clerk, was admitted to the Johannesburg Fever Hospital on 12 February 1957 complaining of headache, nausea and vomiting, and backache. He had been ill for the previous 7 days. This illness began with pain in the neck, fever and moderate headache. The fever subsided after 2 days, but on the 4th day again rose to 102°F and he now complained of severe headache. The temperature returned to normal the following day, but the headache remained, becoming excruciating at times. Two days later he developed stiffness of the neck and he was admitted to hospital with a diagnosis of meningo-encephalitis.

On examination he was found to be afebrile but seemed to be acutely ill. His conjunctivae were red and suffused and appeared to be acutely inflamed. No abnormal enlargement of the cervical glands was detected. The parotid glands and Stensen's duct opening were normal. His throat was slightly reddened. His chest moved well, air entry was good, and no adventitious sounds were heard. The heart was not enlarged and the sounds were closed. The blood pressure was 130/80 mm. Hg. His abdomen was soft and not tender and the liver and spleen were not enlarged. His neck and back became painful on flexion. The Kernig's sign was weakly positive. The tendon reflexes were present and equal on both sides; those of the knee were slightly depressed. A flexor plantar response was obtained.

The urine was darker than normal and had a specific gravity of 1020; a trace of protein was detected, bilirubin was absent, urobilin and urobilinogen was present. Microscopic examination of a centrifuged specimen showed the presence of 2 polymorphonuclear leucocytes per high-power field, with a few epithelial

cells. Bacteriological culture resulted in no growth. Leptospiral culture was not attempted.

A blood count taken on admission showed a haemoglobin of 16.7 g.%, 5,610,000 red cells per c.mm., and 9,600 white cells per c.mm., of which 69% were neutrophil, 0.5% monocyte, 29.5% lymphocytes, 0.5% eosinophil and 0.5% basophil leucocytes. The red cells were normal in appearance.

Examination of the cerebrospinal fluid collected on 12 February showed 295 cells per c.mm., of which 140 were polymorphonuclear leucocytes and 155 were lymphocytes. The protein was 90 mg. per 100 ml., sugar 50 mg. and chlorides 718 mg. The Wassermann reaction was negative. No bacteria were detected on direct or cultural examination. These findings confirmed that this patient had meningo-encephalitis.

A throat swab yielded a culture of pneumococci, scanty haemolytic streptococci and *Micrococcus catarrhalis*. *C. diphtheriae* was not detected.

Liver function tests, the first taken on admission and the second a week later, gave the following results:

Tests	Date of collection of blood in test (1957)	
	13 Feb.	22 Feb.
Thymol turbidity ..	1.5	8.0
Thymol flocculation ..	negative	++
Colloidal red
Cephalin cholesterol
Flocculation test ..	negative	negative
Takata-Ara test ..	negative	negative
Alkaline phosphatase ..	7.6	8.2
van den Bergh ..	negative	negative
Bilirubin direct ..	0.4	0.8
Total ..	7.7	8.4
Albumin ..	4.0	4.3
Globulin ..	3.7	4.1
Gamma globulin ..	1.34	1.99
Cholinesterase	100% of normal

These tests reveal some positive reactions resulting from an increase in the gamma globulin, but do not give other evidence of severe liver damage. The plasma amylase was less than 160 units.

The Widal test on admission gave a positive agglutination of *S. typhi* H in a titre of 1 : 50. A week later the titre had risen to 1 : 100, but this finding was considered not significant and probably an anamnestic reaction. The Weil-Felix test in a titre of 1 : 50 and the brucella agglutination tests in a titre of 1 : 10 gave negative results. The modified Coombs test for brucellosis also gave a negative result as did the Paul-Bunnell test in a titre of 1 : 7.

The rickettsial and the toxoplasma complement-fixation test both yielded negative results on the specimens taken on admission and again 1 week and 2 weeks later.

The leptospiral complement fixation tests gave the following results:

Antigen	Date of collection of blood in test (1957)		
	13 Feb.	22 Feb.	27 Feb.
<i>L. canicola</i> ..	0	1 : 320	1 : 320
<i>L. icterohaemorrhagiae</i> ..	0	1	1 : 80
<i>L. pomona</i> ..	0	0	0

These results indicated clearly that this patient's illness was caused by a leptospiral infection, and suggested that *L. canicola* was the serotype responsible.

Case 2

This patient, E.v.S., an 8-year-old European girl, was admitted to the Johannesburg Fever Hospital on 12 March 1957 from Brenthurst, a suburb of Brakpan, as a suspected case of non-paralytic poliomyelitis. Seven days before admission she had complained of headache and had vomited. A doctor was called, who thought the child had scarlet fever. On the day of admission, when symptoms had become aggravated, the child complained of headache, pain in the legs and stiff neck and back. No weakness was detected. The appetite was poor. The child had not had poliomyelitis vaccine and had had her tonsils removed 5 months previously.

On examination in hospital it was noted that both conjunctivae were mildly injected. The throat was clear, the tonsils were absent and the cervical glands were not enlarged. Her chest moved well, air entry was good, and no adventitious sounds were heard. There was no enlargement of the heart and the sounds were

closed. Her abdomen was soft and not tender, and no masses were felt. The spleen and liver were not enlarged. The neck and back were mildly stiff. Kernig's sign was negative. The tendon reflexes were somewhat exaggerated. No motor weakness was detected.

A blood count taken on the day after admission showed 15.1 g.% haemoglobin, 5,030,000 red cells per c.mm., and 9,000 white cells per c.mm., of which 32% were neutrophil leucocytes, 2% monocytes, 62% lymphocytes, 2% eosinophil leucocytes and 2% plasma cells. The red cells and platelets were normal in appearance, but it was noted that there was a reversal of the neutrophil: lymphocyte ratio and that many lymphocytes had an atypical appearance. However, the Paul-Bunnell test gave a negative result.

The routine biochemical tests on a catheter specimen of urine showed the presence of a trace of protein; sugar was absent. Microscopical examination showed the presence of occasional polymorphonuclear leucocytes. Bacteriological culture yielded no growth.

The liver function tests gave normal readings except that of the total protein of 8.0 g.%, 3.9 g. was albumin and 4.1 g. globulin, of which 1.15 g. was gamma globulin.

Examination of the cerebrospinal fluid taken on the day of admission showed 230 cells per c.mm., of which 20 were polymorphonuclear leucocytes and 210 were lymphocytes. The total protein was 19 mg. per 100 ml., sugar 56 mg. and chloride 758 mg. These findings thus confirmed the diagnosis of meningo-encephalitis.

The routine bacterial agglutination tests, including the Widal, Weil-Felix and brucella tests, and the routine toxoplasma, rickettsial and viral complement-fixation tests gave negative results.

The leptospiral complement-fixation tests gave the following results:

Antigen	Date of collection of blood in test (1957)	
	13 Mar.	21 Mar.
<i>L. canicola</i> ..	1 : 5	1 : 160
<i>L. icterohaemorrhagiae</i> ..	1 : 5	1 : 40
<i>L. pomona</i> ..	0	1 : 20

This significant increase in the titre of complement fixation with these leptospiral antigens indicated that this patient had had a leptospiral infection. The highest titre being obtained with *L. canicola* suggested that this, or a serologically related leptospira, was the cause of the patient's illness.

Case 3

J.D., a girl aged 6 years, was admitted to the Johannesburg Fever Hospital on 5 May 1957, having been sent from the Out-Patient Department of the Transvaal Memorial Hospital by Dr. V. North with a diagnosis of meningo-encephalitis. She had been ill for the past 4 days with headache, vomiting and stiffness of the neck. She had not noticed any weakness of the limbs, but had a slight cough.

On examination she did not appear to be very ill. Her complexion was sallow, but she had no conjunctivitis, and no rash was seen. Her throat was normal and no enlarged glands were found in the neck. Her chest moved well and the breath sounds were normal. A systolic murmur could be heard all over the precordium, but the heart was not enlarged. Her neck and back were slightly stiff, and the hamstring muscles were tight. The cranial nerves were intact. The reflexes were present and equal on both sides. A diagnosis of meningo-encephalitis was made.

In her blood count, it was noted that the haemoglobin was 13.6 g.%, the red-cell count 4,550,000 per c.mm., and the white-cell count 6,800 per c.mm., of which 58.5% were lymphocytes, 41.0% neutrophil and 0.5% eosinophil leucocytes. The red cells and platelets were normal in appearance. The Kolmer and Paul-Bunnell tests gave negative results.

The bacteriological agglutination tests gave negative results except for agglutination of *S. typhi* H antigen in a titre of 1 : 50, which on re-test had risen to a titre of 1 : 200. However, there was no other indication of enteric fever.

In the virus complement-fixation tests, the *Herpes simplex* virus antigen reacted in a titre of 1 : 10. When repeated 1 week later, there had been no increase in titre and this reaction was therefore considered to be the result of a previously acquired infection and not related to the patient's present illness. The

rickettsial and toxoplasma complement-fixation test gave negative results on both occasions.

The leptospiral complement-fixation test gave the following results:

Antigen	Date of collection of blood in test (1957)	
	6 May	11 May
<i>L. canicola</i>	0	1 : 160
<i>L. icterohaemorrhagiae</i>	1 : 5	1 : 10
<i>L. pomona</i>	0	1 : 10

On the result of these complement-fixation tests the diagnosis of leptospiral meningo-encephalitis was made.

The patient's temperature returned to normal on the evening of the day of admission and she made an uninterrupted recovery and was discharged well 19 days later.

This case is of interest in that marked conjunctivitis, a prominent feature of the preceding cases, was not noted.

Case 4

D.J., a girl aged 12 years, was admitted to the Johannesburg Fever Hospital on 8 May 1957. She complained of pain in the legs and back at the onset of illness, vomiting and nausea, headache, and fever of 1 week's duration. She came home from school on Thursday 1 May 1957, 1 week before admission, complaining of pain in her legs and back. This lasted 1 day. On Friday she was very flushed and bilious, and vomited and had severe frontal headache and a temperature of 103°F. Her doctor was called and prescribed sulphadiazine. On Saturday she felt much better. On Sunday her improvement was maintained. On Monday she developed a swollen left cheek, and on Monday and Tuesday she was given penicillin intramuscularly. On Wednesday she developed severe headache and cried all night. Her cheek was still swollen. She was feverish and had a stiff neck and her admission to hospital was arranged.

On examination she was noted to be a well-nourished girl sitting comfortably in bed. She had no pallor, jaundice or cyanosis. Her temperature was 100.2°F, respirations 24 per minute, pulse rate 108, and blood pressure 130/80 mm. Hg. Mild stiffness of the neck was present. Her eyes were clear, the tongue had a strawberry appearance, the tonsils were enlarged, and small glands were felt in the neck. Her chest movements were good and there was no intercostal tenderness. The heart sounds were distant, but no murmurs were heard. Her back was stiff but not painful. Her abdomen was flat and no enlargement of the organs was detected and no rash was seen. There was slight tightness of the hamstring muscles. The cranial nerves were normal. Reflexes were all present and equal, except for the abdominals, which were absent. A diagnosis of meningo-encephalitis was made.

The blood count showed 15.9 g.% of haemoglobin, 5,300,000 red cells per c.mm. and 7,300 white cells per c.mm., of which 66% were neutrophil leucocytes, 7% monocytes, 25% lymphocytes, and 1% eosinophil and 1% basophil leucocytes. The Paul-Bunnell test was negative.

The cerebrospinal fluid was found to contain 73 cells per c.mm., of which 65 were polymorphonuclear leucocytes and 8 were lymphocytes. The protein was 45 mg. per 100 ml., sugar 42 mg. and chloride 730 mg. The Wassermann reaction was negative and no bacteria were detected on direct or cultural examination.

A throat swab culture yielded a mixed growth of *Streptococcus viridans*, *Micrococcus catarrhalis* and pneumococci. No bacteria were isolated from a blood culture in nutrient broth. The serum was found to contain 400 units of streptococcal antihemolysin 0 per ml. The Widal and the brucella agglutination tests gave negative results. In the Weil-Felix test *Proteus OXK* was agglutinated in a titre of 1 : 50.

A poliovirus tissue-culture protection test revealed the presence of antibody to each of the three types of poliovirus.

The routine rickettsial and toxoplasma complement-fixation tests gave negative results.

The leptospiral complement-fixation tests gave the following result:

Antigen	Date of collection of blood in test (1957)	
	9 May	21 May
<i>L. canicola</i>	1 : 5	1 : 80
<i>L. icterohaemorrhagiae</i>	1 : 5	0
<i>L. pomona</i>	1 : 5	0

A significant increase in the complement-fixation test with *L. canicola* was thus demonstrated. This result indicated clearly that the patient's illness was caused by *L. canicola*, or a serologically related organism.

Case 5

A youth aged 15 years, who lived in the same house as the preceding case, was admitted to the Johannesburg Fever Hospital on 21 May 1957. Two days before admission he had been suffering from severe headache, sore throat, and stiffness of the neck and back, but had not noticed any weakness of his limbs. On examination he appeared ill. His conjunctivae were injected. His throat was red but there were no follicles or membrane present on the tonsils. No abnormal signs were detected in his chest. The heart was not enlarged and the sounds were closed. His abdomen was soft and not tender. No masses were detected. His neck was slightly stiff. Kernig's sign was positive. No abnormality of the cranial nerves was elicited and no motor weakness was detected. The reflexes were present and equal. A diagnosis of meningo-encephalitis was made.

A blood count gave the following results: Haemoglobin 16.6 g. %, red cells 5,600,000 per c.mm., white cells 14,000 per c.mm., of which 60.5% were neutrophil leucocytes, 11.5% monocytes, and 28% lymphocytes. The red cells and platelets were normal in appearance and the sedimentation rate 10 mm. in an hour. The Paul-Bunnell tests gave negative results.

The cerebrospinal fluid showed 5 lymphocytes per c.mm., and protein 27 mg. per 100 ml., sugar 67 mg. and chloride 730 mg. No bacteria were detected on direct or cultural examination. The Widal, Weil-Felix and brucella agglutination tests gave negative results. The serum contained 500 units streptococcal antihemolysin 0 per ml. Culture of a throat swab yielded a mixed growth of pneumococci and *Micrococcus catarrhalis* and non-haemolytic streptococci. Bacteria were not isolated from blood cultures taken on the day after admission.

The liver function tests yielded essentially normal results, except for a ++ reaction in the colloidal-red test.

No protein was found on examination of the urine, and bilirubin and urobilinogen were not detected; urobilin was present. Microscopic examination of the deposit from a centrifuged specimen showed the presence of amorphous urates. Cultivation yielded no growth. Porphyrin was not detected.

The routine rickettsial, virus, and toxoplasma complement-fixation tests gave negative results.

The leptospiral complement-fixation tests gave the following results:

Antigen	Date of collection of blood (1957)	
	23 May	3 June
<i>L. canicola</i>	—	1 : 320
<i>L. icterohaemorrhagiae</i>	—	1 : 40
<i>L. pomona</i>	—	1 : 40

The leptospiral agglutination test gave the following results:

Antigen	Date of test (1957)	
	23 May	3 June
<i>L. canicola</i>	0	1 : 10, 240
<i>L. pomona</i>	0	0

These results confirmed that the patient had an infection with *Leptospira canicola*.

All five patients made an uninterrupted recovery and were discharged from hospital feeling well 2-3 weeks after their admission.

Comment

These 5 cases presented an illness lasting a week or longer showing a diphasic fever, during the second phase of which signs and symptoms of meningo-encephalitis developed. Of particular interest were the sudden onset, the pains in the back and limbs, especially in the leg muscles, and, in 3 of the cases, a marked conjunctivitis. These features suggested the diagnosis of leptospirosis, which was made provisionally on clinical grounds in the 3 cases with conjunctivitis. This diagnosis was confirmed by the results

of the leptospiral complement-fixation and agglutination tests.

ORIGIN OF THE INFECTION

Enquiries directed to finding the origin of the infection were made, and in particular the contact of the patients with animals was investigated. In Case 1 (S.G.G.) it was ascertained that the post office in which he worked was infested with rats. He also had a relatively young dog as a pet, and occasionally helped his wife to prepare meals, in the course of which he handled raw meat, usually beef, but occasionally pork. He had not been swimming, picnicking or camping recently, nor had he been in any area where cattle and pigs roamed. About 10 days before the onset of his illness he had attended a motor-car race meeting in a rural area. An inspection of this area subsequently showed that there were no cattle or pigs or damp or swampy ground in its immediate neighbourhood. It seemed more likely, then, that his infection was acquired from contact with the animals in his home environment.

Case 2 (E.v.S.) often played with three dogs in her home, but gave no history of contact with other animals.

Blood was collected from the 4 dogs associated with cases 1 and 2, and submitted to the leptospiral fixation tests, which gave the following results:

Antigens	Serum dilution							
	10	20	40	80	160	320	640	1280
Case 1, Dog G								
L. canicola	+	+	+	+	+	+	±	—
L. icterohaemorrhagiae	+	±	—	—	—	—	—	—
L. pomona	±	±	—	—	—	—	—	—
Case 2, Dog Sn								
L. canicola	+	+	+	+	+	—	—	—
L. icterohaemorrhagiae	+	±	±	—	—	—	—	—
L. pomona	±	±	±	—	—	—	—	—
Case 2, Dog Sp								
L. canicola	±	—	—	—	—	—	—	—
L. icterohaemorrhagiae	±	—	—	—	—	—	—	—
L. pomona	—	—	—	—	—	—	—	—
Case 2, Dog B								
L. canicola	+	+	±	±	—	—	—	—
L. icterohaemorrhagiae	—	—	—	—	—	—	—	—
L. pomona	—	—	—	—	—	—	—	—

These relatively high titres of complement fixation given by the sera from 3 of these 4 dogs clearly indicate that these dogs had or recently had had an infection with *L. canicola*, or a serologically related organism. The history given by the two human patients (cases 1 and 2) of close contact with these dogs, taken in conjunction with these serological findings, clearly suggest that the source of the patients' infection was their dogs.

The relevant history was not obtained from J.D. (case 3), whose parents were unhelpful. However, it was found that the patients D.J. (case 4) and R.W. (case 5) lived in the same house and that D.J. had recently been given a young dog, with which both of them frequently played. This dog was not examined, but in view of the findings in the first two patients it seems probable that it was the source of infection of both these patients.

Several rats caught in the post office where S.G. (case 1) worked were tested for leptospiral antibodies, but these tests gave negative results.

For many years rats and other rodents have been trapped at strategic points in the municipal area of Johannesburg to check the incidence of murine typhus and tick-bite fever infections amongst them. A number of these rats, all *Rattus rattus*, were bled and their sera tested in the complement-fixation tests for leptospiral antibodies. Of 60 rats tested,

58 gave negative results with each of the three leptospiral antigens. One gave a weakly positive reaction with *Leptospira canicola* in a serum dilution of 1:10, but not in the higher dilutions, and negative reactions with the other two antigens, and one serum proved to be anticomplementary in the tests. The titre of the reaction in the serum giving a weakly positive reaction was so low that it was considered of doubtful significance. However, further study of the rats and other rodents for evidence of leptospiral infection is warranted. At present, the serological findings clearly incriminate the patients' dogs as being the source of the patients' infection.

REVIEW OF RECENT HISTORY OF LEPTOSPIROSIS

Leptospiral infections are now known to be one of the commonest causes of benign meningo-encephalitis. Outbreaks have been reported from Europe, Asia, Australasia, America and North and Central Africa. The findings reported in this paper reveal that they are also a common cause of the condition in South Africa. It will therefore be of some interest to give a brief general account of leptospirosis. Fuller accounts of these infections have recently been given by Broom³ and by Kalz.⁴

Since the discovery of the first pathogenic leptospira, *L. icterohaemorrhagiae*, by the Japanese workers Inada and Ido⁵ in 1915, about 40 antigenic types have been differentiated by serological methods. Many of these serotypes are closely related antigenically and may be assembled into groups. Some of the serotypes have a wide distribution, others are more restricted, possibly because of more limited distribution of its host of election. *Leptospira* are primarily parasites of animals and each serotype appears to have a host for which it has specific affinity, though under experimental conditions they may have a wide range of susceptible hosts. Rodents and other small animals are the main reservoirs of infection. However, these organisms are responsible for widespread and often serious disease of a number of domestic animals, including dogs, pigs and cattle, and have been shown to cause infection in a number of wild animals, including mice, voles, bats, mongooses, bandicoots, foxes, jackals and opossum.

Although contact, direct or indirect, with rats and dogs remains amongst the most frequent sources of infection of Man, infection may be acquired from similar contact with other animals or their environment. In their host animals the leptospirae often form colonies in the tubules of the kidneys and are shed in the urine and thus contaminate soil and water and, provided conditions of pH, moisture, and temperature are favourable, may survive for prolonged periods.

Man may acquire his infection from contact with water, mud or damp soil in such a contaminated environment or directly from contact with the urine or tissues of infected animals. The leptospira gain entrance through cuts or abrasions of the skin, or through the mucous membranes of the eye and nose. They then give rise to a generalized infection, which may penetrate the blood-brain barrier causing a meningo-encephalitis. The brunt of this infection is borne by the kidneys and liver, which in fatal cases show characteristic lesions. The liver may be swollen and on microscopical examination show dissociation of the liver cords. Sometimes necrosis of the cells round the central

vein is apparent and there is an infiltration of cells in the portal tracts. The kidneys are often enlarged and show changes varying from cloudy swelling to necrosis of the convoluted tubules and loops of Henle. The medullary tubules contain cellular casts. The glomeruli are little affected. There may also be interstitial oedema and peritubular infiltration of inflammatory cells.

The spleen may be enlarged and diffuent and show focal haemorrhages. The fibres of voluntary muscles, especially of the gastrocnemius may show loss of striation and hyaline degeneration.

Amongst the commonly recognized diseases of Man caused by leptospiral infections are Weil's disease, Canicola fever, and swineherd's disease. There are a number of others less well known, such as 'mud' fever, 'cane cutters' fever and rice-field fever. Fort Bragg fever, a condition affecting soldiers in the United States Army in several of the training camps in America during World War 2, has also been shown to be caused by a leptospiral infection.⁶ The salient features of the more important of these diseases will be noted:

Weil's Disease

Weil's disease is caused by *Leptospira icterohaemorrhagiae*, of which the sewer rat, *Rattus norvegicus*, is the most important reservoir host. A number of other rodents have also been shown to harbour the infection. Man usually acquires the disease in a rat-infested environment, where the water, slime, or soil may be heavily contaminated by infected urine. Outbreaks of this origin have occurred amongst the workers in coal mines, fisheries, and sewers. Cases are also frequently reported after deliberate or accidental immersion in water of rivers, canals or ponds.

The incubation period has an average of 7–14 days. The onset is sudden, with high fever, headache, chilly feelings and muscle pain, particularly of the calf muscles, followed by anorexia, vomiting and abdominal pain. Conjunctivitis and nose-bleeding are features of most cases. Leptospirae are present in the blood and may be demonstrated by culture, animal inoculation or, more rarely, by dark-field microscopic examination of the serum sediment. This first septicaemic phase of the disease lasts 3–7 days, when the fever falls by lysis, but is followed in many cases by a second wave of fever, during which signs of involvement of the liver become apparent. Jaundice may be seen in some cases, but tenderness and enlargement of the liver are also found in many cases without icterus. A tendency to haemorrhage results in petechial haemorrhages, haematuria and melaena. The liver function tests show impairment at this stage.

Clinical signs and symptoms of renal involvement also become manifest. The urinary output is decreased and albumin, red cells, white cells and hyaline and granular casts are found in the urine. Cases which end fatally usually do so between the 10th and 17th day and death is most often due to renal failure.

Some cases develop signs and symptoms of meningeal involvement, but involvement of the central nervous system appears to be less prominent a feature of Weil's disease than of other leptospiral infections. Convalescence is often protracted and may be interrupted by further febrile relapses and by the development of complications such as iritis, iridocyclitis and optic neuritis.

Canicola Fever

Canicola fever is caused by *Leptospira canicola*, of which the dog is an important but not the only reservoir. Man most often acquires the infection from contact with dogs. These animals may have overt signs of disease, including bloodshot eyes, anorexia and vomiting, fever, and signs of renal damage, followed sometimes by death from kidney failure. Often they have relatively silent infections. Pigs, cattle, horses, donkeys and jackals may also be sources of infection.

The infection in Man may cause an illness resembling Weil's disease. However, it is as a cause of aseptic meningitis that *L. canicola* has attracted most attention. The clinical features of this illness have been illustrated in the descriptions of the cases in the first part of this paper.

Swineherd's Disease

Leptospira pomona was first identified as a distinct serotype by Clayton *et al.*⁷ in Australia, where it has been incriminated as the cause of red water in calves. Pigs infected with this leptospira may show no clinical signs of illness, but may suffer impoverishment and lowered resistance to other infections. The infection may cause serious losses in herds of cattle.

In 1944 it was shown by Gsell⁸ that this leptospira was the cause of swineherd's disease in Europe. The clinical features of this illness are an acute onset, with photophobia, myalgia, transient skin rashes, and high fever, often showing a biphasic course. During the second bout of fever the patient often develops a severe headache, stiff neck and back, and other signs of meningitis. The cerebrospinal fluid usually shows a pleocytosis mainly of lymphocytes, and an increase in protein, with relatively normal values of sugar and chlorides.

The condition in Man is usually benign and the patient usually makes an uninterrupted and complete recovery without any sequelae, although convalescence may be protracted.

DIFFERENTIAL DIAGNOSIS

In the differential diagnosis of Weil's disease the other causes of illnesses with an acute onset, high fever, and enlargement and tenderness of the liver, associated sometimes with jaundice and other signs of hepatic and renal dysfunction, have to be considered. These include infective hepatitis, yellow fever and Rift Valley fever, glandular fever, Q fever, the enteric fevers, relapsing fever, and the bilious remittent form of malaria.

In the differential diagnosis of Canicola and Pomona fever with involvement of the central nervous system, the other causes of benign aseptic meningitis have to be considered. Chief amongst these are the viral causes of meningo-encephalitis, including infections due to poliovirus, Coxsackie and ECHO viruses, and mumps virus and herpes virus. There are a number of other viral and non-viral conditions which may also cause difficulty.

The differentiation of Weil's disease from clinically similar illnesses, and of Canicola and Pomona meningitis from other causes of the aseptic meningitis syndrome, is usually only possible by a comprehensive series of laboratory tests specifically designed for this purpose. In most advanced countries these laboratory facilities are now available. In South

Africa they are provided by the South African Institute for Medical Research and the Poliomyelitis Research Foundation.

TREATMENT

A number of antibiotics have been shown to have a lethal or inhibitory effect on leptospiral infections under experimental conditions. Favourable results have also been reported in cases treated with penicillin in large doses, streptomycin, chloramphenicol, aureomycin and tetracycline, or these antibiotics in various combinations. Other reports are less favourable. It is clear that the evaluation of these antibiotics in a disease so variable in its severity and course as leptospirosis is difficult. However, although it has not yet been proved that these antibiotics are of specific value, they may be beneficial and should be given a trial, especially in patients who are severely ill.

Prevention

In the prevention of leptospiral infections, it is necessary first to define the extent of the problem and to detect the important reservoirs of infection and the conditions under which it is spread. In the cases in which rodents are the chief vectors of infection, anti-rodent measures may be successful in controlling it. Widespread infection of dogs would in practice be more difficult to control. Advice may be given to lessen intimate contact between potentially infected dogs and Man, but in practice it is doubtful whether it would be followed. It may prove possible to treat dogs prophylactically with drugs and antibiotics, which would eliminate their infection and so the danger of passing it on to their human masters. However, again it is doubtful whether such measures would be widely applied. Fortunately the infection acquired from dogs is usually relatively benign.

The public should be warned of the danger of paddling, bathing or swimming in rivers, canals and ponds, where these are known to be infected. In South Africa cases have not yet been traced to this source, but investigations should be carried out to determine the importance of contaminated water and soil in spreading leptospiral diseases.

SUMMARY

The clinical findings in 5 cases of meningo-encephalitis admitted to hospital with a provisional diagnosis of non-paralytic poliomyelitis are described. These patients had an illness lasting about 1 week, characterized by headache, conjunctivitis, muscle pains, and fever often showing a biphasic course, during the second wave of which they developed signs of meningitis, severe headache, stiff neck and back and a pleocytosis in the cerebrospinal fluid mostly of lymphocytes.

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The diagnosis was established in each case by serological tests, the complement-fixation and agglutination tests, which showed the development of antibodies against leptospira in the convalescent-phase blood as compared with negative results given by the acute-phase blood. The titre of antibody was significantly higher against *L. canicola* than against *L. icterohaemorrhagiae* or *L. pomona* and it was concluded that *L. canicola*, or a closely related organism, was responsible for the illness. It was found that the blood sera of 3 of the 4 dogs belonging to 2 of the patients also gave high-titre complement fixation against *L. canicola* and that the other 3 patients had had close contact with dogs, but not with other animals. It was concluded that the source of the patients' infection was their dogs.

The epidemiological features of leptospiral infections, of which about 40 antigenic serotypes have been differentiated, are briefly reviewed, noting that Man acquires his infection either directly or indirectly through contact with animals. Rodents and dogs are the most important reservoirs of infection, though cattle and pigs and a number of other domestic and wild animals have also been shown to harbour and excrete leptospirae pathogenic to Man. The epidemiological and clinical features of leptospiral jaundice or Weil's disease, Canicola fever and Pomona fever, or swineherd's disease, are briefly noted.

The value of antibiotic treatment has not yet been clearly assessed. These diseases may be prevented by avoiding contact with infected animals and their contaminated environment, and by eliminating infected rodents and possibly by the appropriate treatment of infected domestic animals, but in practice these measures may be difficult to enforce.

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ARSINE POISONING IN INDUSTRY

A REPORT OF 2 CASES

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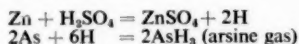
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The dangers of arsine (arseniated hydrogen) poisoning have been recognized since 1815, when Gehlen, a Munich chemist, in the course of some researches 'inspired a small portion and at the termination of one hour was seized with continual vomiting, shivering and weakness, which increased until the 9th day, when he died'.¹

The first cases reported in industry occurred in 1873 in Germany,¹ during the process of recovering silver from lead and zinc ores. A considerable number of cases have since been reported. In 1908 Glaister² reviewed 120 cases, and in 1932 Meulberger *et al.*³ stated that 247 cases were on record, of which 50 were fatal. In recent years comparatively few reports have appeared in the literature and in 1952 Locket observed that since 1935 only 10 cases had been reported in England.⁴ Reports however still appear with sufficient frequency to emphasize the importance of arsine as a serious though preventable industrial hazard.

The majority of accidents in industry have been due to the use of acids, alloys or ores contaminated with arsenic, or arsenical compounds. Tin, lead, aluminium, and zinc ores have been most commonly incriminated. Many industrial processes are potential hazards, and cases have been reported in the tin refining,^{4, 5} and lead smelting^{6, 7} industries, in the cyanide extraction of gold,⁸ and in the manufacture of arsenious acid.⁹ Cases have also occurred in the galvanizing industry, in the manufacture of zinc chloride, zinc sulphate and hydrogen, and as a result of the cleaning of acid tanks. An unusual instance was that occurring in a submarine from the arsenic contamination of the lead in the accumulators.²³

Arsine may be produced by the combination of nascent hydrogen and elemental arsenic



or by the reaction of water with a metallic arsenide.



Both types of reaction readily occur at room temperature and lethal quantities of arsine can be produced within a short space of time. No previous records of this condition occurring in South Africa have been found and, in view of the rapid development of industry in South Africa today, it seems important to report 2 cases of arsine poisoning which occurred recently. It is desired to draw the attention of industrial medical officers and general practitioners practising

in the vicinity of industry to this condition, and to stress its importance as an industrial hazard.

CASE 1

J. 4148, an African male aged 25 years, was admitted to hospital on 1 May 1956 complaining of abdominal (peri-umbilical) pain and of passing black urine. The pain was severe and colicky and came on suddenly during the night. There had been no dietary indiscretion, and no other symptoms were referable to the gastrointestinal tract. The black water was of maximum intensity from the outset and was unaccompanied by pain on micturition or other urinary symptoms.

The patient had been admitted to hospital 5 months before for a similar complaint. The chief complaint then was painful micturition, and ward records showed that later he developed jaundice, haemoglobinuria and abdominal pain. There was also an initial pyrexia and cough, accompanied by nausea and vomiting. He was treated with antibiotics and by the 4th day all symptoms and signs had disappeared. On discharge the haemoglobin value was 10.9 g.% and his white-cell count was 6,600 per c.mm. He remained well until the present episode.

For the past 10 months the patient had been employed in a chemical factory. He had not been outside Johannesburg during this period. Further details regarding the patient's occupation are given below.

Clinical Examination and Course. The patient was a well-nourished African male in no obvious distress. Temperature 100°F. The mucous membranes were pale but there was no jaundice, cyanosis, purpura, or skin rashes. Clinical examination was otherwise negative. There was no enlargement of the liver or spleen and no significant lymphadenopathy. Physical examination of the central nervous system was negative at the time of admission and has remained so, the last clinical examination being made 4 months later. The progress of the case was uneventful; the pyrexia settled by the 2nd day and the abdominal pain disappeared by the 3rd day. On the 4th day the urine was quite normal in colour. The patient received no specific therapy.

Laboratory Investigations. The urine was of port-wine colour. Albumen + + +. Sugar absent. Bilirubin absent. Urobilin + +. Microscopic examinations of a centrifuged deposit showed no cells or casts. Bilharzia ova were not observed. The blood picture is shown in Table I. A moderately severe normochromic anaemia was found. The red-cell fragility test showed that haemolysis commenced at 0.5% saline and was complete in 0.3% saline. The incubation autolysis test¹⁰ showed 0.5% lysis after 24 hours. The Coombs test, both direct and indirect, was negative. Ham's acid serum test and the Donath-Landsteiner test were negative. Paper electrophoresis of haemoglobin showed normal adult haemoglobin only. No malaria parasites were seen on thick or thin films, and Heinz bodies were not observed. The Schumm's test performed 2 days after admission was negative and the serum bilirubin was less than 0.5 mg.%. The modified Ide test was negative. A bone-marrow examination carried out on the 9th day in hospital showed an active hypercellular marrow, with a myeloid-erythroid ratio of 1 : 3. Erythropoiesis was normoblastic, but markedly hyperactive. In view of the haemoglobinuria,

anaemia, reticulocytosis and marked erythroid reaction in the marrow, a diagnosis of a haemolytic anaemia was made. The cause seemed most likely to be a factor of extrinsic origin, and a

TABLE I. CASE 1. HAEMATOLOGICAL DATA

	1955 18 Dec.	1956 1 May	1956 3 May	1956 9 May	1956 28 May	1956 1 Aug.
Haemoglobin (g.%)	10.9	10.3	9.6	10.2	13.5	16.7
Red-cell count (millions per c.mm.)			3.2		4.7	5.4
Packed cell volume %			29		42	
Reticulocytes %		7.2	15.0	6.0	2.0	4.0
Normoblasts (per 200 w.b.c.)		13	9	0	0	0
White blood cells (thousands per c.mm.)	6.6	6.4	4.2	9.6	1.9	4.0

search for possible haemolytic agents to which the patient might have been exposed was accordingly undertaken. While these investigations were in progress a second case was admitted to the same hospital.

CASE 2

On 10 May 1956, 9 days after the admission of case 1, J. 5908, an African male aged 30, was admitted complaining of passing black water. At first there was no pain but later he developed central colicky abdominal pain. There were no other gastro-intestinal symptoms. Apart from passing black urine there were no urinary symptoms. He gave a history of a previous similar attack, which had occurred 1 month before and for which he had been admitted to hospital. Haemoglobinuria was observed on that occasion, with pyrexia of 100.8° F. This patient had been employed at the same factory for the same length of time as case 1 and worked in the same section. These two men and a third were the only persons working in that particular section. Further details of the patient's occupation are outlined below.

Clinical Examination. The patient was a well-nourished African male. Temperature 100.6° F. There was no pallor of the mucous membranes, but slight jaundice was present. Physical examination revealed a 2-finger-breadth enlargement of the liver below the right costal margin. The liver was smooth and non-tender. The spleen was not palpable, nor was there any lymphadenopathy. The remainder of the clinical examination was negative.

Laboratory Investigations. The urine was of port-wine colour. Albumen +++. Sugar absent. Bilirubin absent. Urobilin +. Urobilinogen +. Spectroscopic examination showed the presence of haemoglobin derivatives and methaemoglobin. Microscopic examination of a centrifuged deposit showed the presence of 1-2 leucocytes per high-power field and calcium-oxalate crystals. The blood findings in this case are shown in Table II. All the

TABLE II. CASE 2. HAEMATOLOGICAL DATA

	11 May 1956	13 May 1956	28 May 1956	1 Aug. 1956
Haemoglobin (g.%)	13.5	10.6	14.6	16.9
Red-cell count (millions per c.mm.)		3.7	4.9	5.4
Packed cell volume %		30	46	
Reticulocytes %	5.0	13.5	1.5	1.0
Normoblasts (per 200 w.b.c.)	0	0	0	0
White blood cells (thousands per c.mm.)	9.1	7.2	2.4	3.9

special haematological tests outlined in the investigation of case 1 were negative in this case, with the exception of the Schumm's test, which was positive. The serum bilirubin was 0.6 mg. % 2 days after admission. The modified Ict test was negative. Malaria parasites were not detected. A bone-marrow examination on the 4th day in hospital showed a hypercellular active marrow with a myeloid-erythroid ratio of 1.2 : 2. Erythropoiesis was hyperplastic and normoblastic in type. Subsequent progress of this

patient was uneventful, the temperature returned to normal in 3 days, by which time the jaundice had disappeared and spectroscopic examination of the urine did not show the presence of haemoglobin or any of its derivatives. The liver could no longer be felt by the 5th day. In 10 days the haemoglobin value had risen to within normal limits.

DISCUSSION

Two cases occurring in the same section of the same factory and presenting as haemolytic anaemias pointed obviously to the operation of some extrinsic factor connected with their occupation. A search for a history of exposure to a haemolytic agent at the place of employment was accordingly made. A third man who worked with these two patients was also examined. This man, an African male aged 25, had been employed in the same work as cases 1 and 2 since May 1955. He did not volunteer any complaints, but on direct questioning admitted to a recent episode of passing black urine; he was unable to specify the time of the attack with accuracy. There were no symptoms with this attack, which cleared up within a few days without treatment. Clinical examination revealed no abnormalities of significance. Urine examination revealed the presence of macroscopic haematuria and numerous bilharzia ova. A full blood count performed on 28 May 1956 showed a haemoglobin value of 13.5 g.%, packed cell volume 35%, and red-cell count 4.7 million per c.mm. The white-cell count was 6,000 per c.mm., with a mild eosinophilia in the differential count. A reticulocytosis of 4.5% was found. In view of the history of having passed black water and the presence of mild anaemia and a reticulocytosis, the possibility of haemolytic anaemia was considered. However, the bilharzia could have accounted for all these observations, and this case cannot be considered a proved haemolytic anaemia. Arsenic estimations were carried out on this patient nevertheless and are reported below.

Description of Working Conditions

These three men worked together in one section of the factory and were the only persons employed in this particular section. Their task was to shovel zinc ash into large cauldrons of boiling sulphuric acid. The men stood on a platform above the cauldrons and might have been exposed to fumes arising from them. Arsenic is a frequent contaminant of zinc ash and the material in use in the factory was analysed by the factory analyst, who reported as follows on a sample received on 25 May 1956: 'Arsenic as arsenious oxide (As_2O_3) 8 parts per million (Gutzeit method), arsenic as free arsenic 6 parts per million. Addition of sulphuric acid to the zinc ash results in the liberation of a large proportion of the arsenic in the form of arsine.' Subsequent investigation failed to detect the presence of antimony in the zinc ash and stibine was not liberated by sulphuric acid. Arsenic estimations on the nails and hair and the urine of the patients were made, and urine estimations were also made on 3 healthy controls employed elsewhere in the factory. The results are shown in Table III. These findings confirmed the tentative diagnosis of arsine poisoning.

It is clear that in the circumstances described above the conditions were ideal for the production of arsine by combination of nascent hydrogen and free arsenic. Although the men had worked in the factory for nearly 12 months they had each suffered only two attacks (except case 3, who had

TABLE III. ARSENIC CONTENT OF NAILS, HAIR AND URINE

Specimen	Date	Case 1	Case 2	Case 3	Controls		
					1	2	3
Nails and Hair (estimated together)	4 June 1956	240 parts per mil.	14 parts per mil.	37 parts per mil.	—	—	—
Urine	19 Aug. 1956	0.5 mg. per litre	0.4 mg. per litre	0.6 mg. per litre	0.0 mg. per litre	0.0 mg. per litre	0.1 mg. per litre

only one attack). It is difficult to explain the infrequency of the attacks, and the nature of possible precipitating factors is not known. A possible explanation is the use of a particular batch of zinc ash or sulphuric acid more heavily contaminated with arsenic than usual.

Arsine Poisoning

In view of the long period of exposure to the potentially dangerous atmosphere it was not possible to determine the period of exposure responsible for the attacks in our cases. Reports in the literature, however, indicate that comparatively short periods of exposure sometimes produce symptoms. In a case reported by Lockett *et al.*⁹ symptoms commenced within $\frac{1}{2}$ hour of exposure, and in the Indiana outbreak reported by Spolyar and Harger⁷ symptoms commenced $1\frac{1}{2}$ to 7 hours after exposure.

The maximum safe concentration of arsine recommended by the American Conference on Governmental Industrial Hygiene is 0.05 parts per million (quoted by Morse and Setterlind⁶). Henderson and Hagard¹¹ state that 3-10 parts per million will cause symptoms after several hours' exposure and 16-60 parts per million are dangerous after $\frac{1}{2}$ hour's exposure. Nau,¹² in animal experiments, was able to produce a mild chronic haemolytic anaemia in rats after exposure to an atmosphere containing 0.05-2 parts per million of arsine for 1-3 hours daily to a maximum of 144 hours.

The clinical features of arsine poisoning are well reviewed by Lockett *et al.*⁹ and by Hunter.¹ The most striking features are the acute intravascular haemolysis and the frequent occurrence of oliguria and anuria. Abdominal pain, nausea, diarrhoea, vomiting and headache, followed by jaundice, anaemia, haemoglobinuria and methaemoglobinuria, are the common presenting symptoms. Wills¹³ noted a parboiled redness of the face in his fatal case, and a garlic-like odour of the breath was observed by Bulmer *et al.*¹⁴ Severe cases rapidly develop oliguria and anuria with increasing uraemia and all the features of acute tubular necrosis. Of the reported cases which developed anuria the mortality approaches 100%.⁹

The cases reported here were mild attacks, the most striking feature of which was the haemoglobinuria and anaemia. Constitutional disturbances were mild and neither patient developed oliguria or anuria. Recovery occurred rapidly and appeared to be complete in spite of the persistence of arsenic in the urine 3 months after the attack.

The mortality of arsine poisoning is given as 20% by Kober,¹⁵ as 31.4% by Glaister,² and as 28% by Bomford and Hunter.⁴ In Spolyar and Harger's series,⁷ 4 of 13 cases died. It is possible that these figures are unduly high owing to the fact that mild cases may have been missed.

Arsine has been shown to act directly on haemoglobin¹⁶ in the presence of oxygen to produce choleglobin, methaemoglobin, methaemalbumin and probably other haemoglobin pigments. Arsenite and arsenate rapidly convert methaemoglobin to haemoglobin,⁹ so that intracorporeal arsenite and arsenate are unlikely to be responsible for the presence of methaemoglobinuria. Pathogenesis of the renal lesion in arsenic poisoning is not clear, but Lockett *et al.*⁹ suggest that it may be anoxic in origin. Josephson *et al.*,¹⁷ believe that, in addition, arsine has a direct action on the heart. This view is based on autopsy and electrocardiographic findings indicative of acute myocarditis in their cases. Confirmation of these findings in further cases will be of considerable interest.

Prevention of arsine poisoning is primarily a problem of factory organization and design. Hunter¹ advised the use of respirators where arsenic is known to be present. Koelsh¹⁸ suggested using small birds to detect arsine, and more recently Bamford¹⁹ described the use of silver nitrate on mercuric-chloride test papers. Treatment of the established case follows standard therapeutic principles. Anaemias, if severe, should be treated with blood transfusion. Oliguria and anuria are best treated on the basis of the principles laid down by Bull, Joekes and Lowe.²⁰ B.A.L. has been used in many of the reported cases, but the results have been uniformly disappointing.^{21, 8} Experimentally, Kensler *et al.*²² have shown that B.A.L. could only produce beneficial effects if given within 45 minutes of exposure. This virtually excludes the possibility of benefit in most clinical cases. Lockett *et al.*⁹ also mention the use of exchange transfusions which may be of value during the first 6 hours of an attack.

SUMMARY

Two cases of arsine poisoning occurring in factory workers engaged in dissolving zinc in sulphuric acid are reported. A possible third case is also mentioned. These cases are believed to be the first reported in South Africa. The production of arsine in industry, the toxic action of the gas, its lethal dosage, and the clinical features of arsine poisoning are briefly discussed.

We are grateful to Mr. M. Rigele for all the arsenic determinations.

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SURGERY OF THE HAND*

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The mobility and the strength of the hand are dependent on a great detail of anatomical structures. Bones, joints, ligaments, long and short tendons with their pulleys and sheaths, short muscles, nerves, blood vessels, and the skin, are all packed within this small space between fascia and areolar tissue. The latter is the gliding material that allows one structure to move unhindered on or with its neighbour.

The function of the hand can be almost completely lost by the replacement of this gliding material by scar tissue. This is best illustrated in a hand caught between rollers and suffering from extensive skin injury and the deeper wounds of serious fracture dislocations. Although the fracture dislocations may be immediately reduced and the skin cleansed and repaired, the subsequent *superficial* and *deep* scar tissue may completely cripple the hand, although the rest of its anatomy is in continuity.

Looking for a section within surgery of the hand that I could cover within my time limit, I have chosen the prevention of scar tissue.

Since hand infection is the major cause of scar tissue its prevention is the first consideration in all repair surgery of the hand.

The hands are the most exposed parts of the body. As the result of their exposure and the jobs man and the devil put them to, the intact skin of the hand is continually contaminated by a wide variety of pathogenic organisms. For example: In the act of blowing the nose or coughing the contaminants are the naso-pharyngeal streptococci and staphylococci; in another physiological act they are the coliform group; on the muck-stained hands of agricultural workers or gardeners they may be the anaerobes of gas gangrene or tetanus.

When the skin of the hand is broken these contaminants are driven into the depths of the wound. The wounding instrument itself is *generally* bacteriologically clean—at least, the presses, the capstan lathes and the other tools we swabbed in industrial Birmingham were so. But the wounding instrument plays an important part in the story of hand infection, not only by the division and displacement of important hand structures and the creation of dead spaces,

* Based on an address delivered at a plenary session on 'The Surgery of Repair' at the South African Medical Congress, Durban, September 1957. Mr. Gissane's address was illustrated by a number of lantern slides.

but equally important by the damage it may cause to the blood supply of these and neighbouring structures.

Forty years ago Almroth Wright believed that most of the evils of septic infection could be prevented if the wound could be quickly brought to a clean condition, in which healthy leucocytes could cope with any remaining contaminants and the wound could safely be closed. More recently the research of Ashley Miles and his colleagues has proved that the major factor in the prevention of infection is that the circulatory response of the wounded tissues *within the first hour* of injury should bring up a sufficiency of leucocytes and specific antitoxins to aid the effective elimination of the contaminants. This is the basic knowledge upon which we now base our repair planning and our surgical techniques. The picture emphasizes not only the urgency of surgical intervention but also its primary objective, namely, to handle all damaged tissues gently and by surgical measures to improve the blood supply of the wounded area.

TREATMENT OF HAND INJURY

Immediately after a hand injury the first step is a preliminary clinical and radiological examination and the formation of a plan for functional repair. This is followed by the application of a good cover dressing to prevent added infection whilst the patient awaits operation.

Under general anaesthesia a further examination of the hand injury is made in which the detailed plan for repair is finalized. This is followed by a thorough but very gentle washing of the whole hand and the forearm by the surgeon himself. This washing involves the most gentle handling of all damaged tissues. After cleansing, a pneumatic tourniquet is applied; the usual aseptic precautions are taken and the operation commenced. The surgery of the hand is unhurried, gentle and precision work. To achieve this standard the bloodless field provided by a tourniquet is as important as a high standard of anaesthesia. I prefer a fully anaesthetized patient. The amount of repair undertaken at the first operation must be left to the judgment and the abilities of the surgeon. For my part I like to hold the tourniquet time down to 1 hour, for I believe that the longer a wound is exposed under a bloodless field the higher the risks of infection.

The all-important objectives at the initial repair are the removal of foreign bodies, dead tissue and badly devitalized tissue. This is restricted to a minimal excision of tissue,

particularly of the skin. The next objective is the elimination of all dead spaces; this is frequently achieved by the reduction of badly displaced fractures and dislocations. To these may be added (at the surgeon's discretion) the repair of divided deep tissues such as tendons and nerves; such repairs demand a very high degree of technical craftsmanship. Finally the skin should be closed either by direct suture or by skin graft. The only exception to the skin-closure rule is in the bursting type of injuries without skin loss, in which the tension of sutures may further devitalize the skin. Closure of the wound in such injuries is by light-pressure cover dressing. Finally the hand is immobilized in a position of function, the whole hand being covered, leaving only the tip of the thumb exposed to check the circulatory responses.

Skin Sutures and Skin Grafts

The techniques of skin suture and the choice of skin graft are important technical matters. Skin suture must be accurate and never under tension, and the sutures must be placed in parallel and evenly spaced, leaving no superficial or deep dead space. In the repair of other divided tissues in the hand—for example, nerves or tendons—the same principle of careful surface-to-surface apposition and the avoidance of dead spaces between the divided ends is all-important. The methods of placing these sutures will differ according to the structure under repair.

The type of skin graft chosen to make good a skin defect in the hand is an equally important technical consideration. If the only objective is to avoid added infection then a split-skin graft of a thickness suitable to the site is the safest and best graft of all. If, in addition to skin cover, the purpose is to bring an additional blood supply to the wounded area and also to provide a new gliding material for the underlying tissues, then the method of grafting must be either by local flaps for small skin defects or, for larger defects, by flaps taken from more remote areas.

It should be noted that the defect to be covered by local flaps is achieved by moving skin from the area immediately adjacent to the wound. The blood supply of this area is often damaged by the violence of the wounding, and if it is further damaged by surgery it may die. Local skin flaps at the acute stage of injury must therefore never be lifted unless their blood supply is quite normal.

Flap grafting, both local and remote, when properly used in acute hand injuries, gives very good skin cover, immediately brings a new blood supply to the wounded area, and is a method of choice if later surgery for the repair of deep structures is contemplated.

SCAR TISSUE

The avoidance of deeply placed scar tissue, particularly after closed hand injuries, depends upon a better understanding than we have now of the detailed anatomy of the injury under treatment. Once we have this knowledge we shall be better able to assess the relative methods of so-called conservative treatment against the benefits and the hazards of open repair. For example, the loss of finger movement is not unknown after a closed dislocation of the proximal interphalangeal joint. In such a injury the capsule of the joint must be torn and the tear may extend into the common flexor sheath. If after closed reduction the displacement of these soft tissues remains, then an excess of deep scar tissue may bind down the flexor tendons to the wound of the joint

capsule. Because this happens on occasions it would not be profitable to operate on all closed interphalangeal dislocations. Yet there are definite indications for open repair of such injuries, and there are many closed and open injuries of the hand where the surgery of early accurate repair of deep tissues is necessary.

It is my experience that operations on deeply seated scar tissue in the hand, months and years after the initial injury, are always difficult and never completely successful.

Reviewing, some years ago, our Birmingham experience in the treatment of all types of injury to all parts of the body, I was not unduly surprised to learn that the severest types of hand injury involved a period of absence from work which averaged 275 days from the date of injury to the return to some type of gainful employment. This was a longer average time for treatment than that involved by injury to any other part of the body.

BASIC FUNCTIONS OF THE HANDS

In the past we have often wasted a great deal of time and run very considerable risks of dangerous complications in severe hand injuries by following the old rule of saving everything that had a chance of living. A viable finger with multiple fractures and tendon and nerve injuries can at best be completely stiff as the result of inevitable scar tissue but—what is worse—this stiffness frequently interferes with the movement of the neighbouring fingers and considerably delays the functional recovery of the hand as a whole. Now our plan in multiple hand injuries is to save fingers that have a chance of useful functional recovery. This way of thinking simplifies what at first sight may look an impossible repair problem. Using it, we now very seldom amputate the hand, for we believe that almost any functional hand remnant is an improvement on an artificial hand or any type of arthroplasty.

When planning the repair of a badly mutilated hand we come back to the hands' basic functions:

First, the hand is the body's sensitive antennae, a man with both hands amputated appreciates this.

Next, it is a pincer. The retention of any part of the thumb and any remnant of a finger if one or both are fully mobile will achieve this most important function.

The hand is also a hook with which to carry and handle things. I have retained the hand of a young girl with the little finger its only active digit. This patient has been a two-handed telephone operator now for many years.

The hand is also a vice to hold things firmly and for this purpose it requires as little as two fingers and most of the thumb.

Finally, the most primitive form of the hand is one in which it is used as a clamp to hold things down. If the clamp has good sensitive skin cover it is a worth-while tool. This function can be achieved with only the base of the hand.

Major hand injuries are almost exclusively a problem of industrial injury. Workmen are not as interested in the appearance of their hands as in their useful function. Indeed it is not an uncommon experience for a workman to demand the amputation of fingers after extensive surgery that has ended to the complete satisfaction of the surgeon. Finally, our experience with severe hand injuries is that the average workman will not stand up to a long series of repair operations. Indeed, at the end he will often put the repaired hand in his pocket, or in someone else's pocket, and keep it there.

THE PSYCHO-SOCIOLOGIC APPROACH TO THE PROBLEM OF NEOPLASIA*

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The psycho-sociologic approach to any clinical phenomenon, neoplasia for example, presupposes a conception of man as a body-mind in 'organic' continuity with the multiform environment. Such an approach, however, is logically derived from the contemporary conception of *causality*, a conception which rejects unreservedly the methodological outlook of the older schools of philosophy, according to which biological, psychological and social processes are regarded as independent entities, each capable of assuming absolute causal power, and so of producing a single one-sided effect. The concept of cause and effect projected by the older schools, and enshrined in the dictum *Causa aequat effectum*, presupposes a relationship of one-sided dependence between two events, be they biological, psychological or social. But such a fancied relationship does not reflect the full reality of change. The concept of causality does not, in fact, admit of the principle of dualism, for no event can be dependent upon one cause alone. Each 'cause' itself must be considered in turn as the effect of another 'cause', and each effect as the cause of further effects, so that a particular phenomenon under investigation, neoplasia for example, is construed to be the expression of a chain of causal factors which has the character of a continuum. In this conception, the factors in the causal continuum are interdependent with, or functionally related to, one another. Any clinical event may thus be symbolized by the notation:

$$Y=S(p \rightleftharpoons q \rightleftharpoons r \rightleftharpoons s \dots)$$

One of the factors in a causal chain is always decisive or dominant in the sense of precipitating change or disequilibrium. It is thus the essential task of investigative medicine to identify the dominant variable in the causal chain, and then to determine the extent to which the pathologic process has traversed the diverse components of the human continuum.

This *a priori* evaluation of causality has been amply validated by a series of psycho-somatic and medico-sociological studies. It has given rise to the integralistic school in medical philosophy—a school promoted in the Department of Preventive and Social Medicine of the University of Witwatersrand—according to which the human personality is conceived not as a body and mind operating as independent entities, but as an inter-acting body-mind in continuity with a multi-dimensional environment.⁵ In effect, in this concept, the soma with all its components, and the psyche with all its components, are construed as being in a state of continuous interaction one with the other.

The psycho-sociologic approach to the problem of neoplasia, therefore, necessarily involves the procedure of

identifying and correlating the gamut of factors as they emerge from (a) the individual somato-psyche personality, and (b) the multiform environment in which the individual personality is projected. The causal factors *vis-a-vis* carcinoma may be referred to as carcinogenic factors. These factors, however, are not constant, and, in so far as they vary from one individual to another, they are more correctly referred to as variable carcinogenic factors. Thus we may now postulate, on the basis of medico-sociologic data to be presented, that—

I. The susceptibility of an individual to carcinoma in particular, and to neoplasia in general, is determined by

(A) variable factors operating in the somato-psyche personality; and by

(B) variable factors operating in the surround; and that

II. The incidence of carcinoma in a community is determined by variable factors operating in the multiform environment.

I. THE SUSCEPTIBILITY OF THE INDIVIDUAL SOMATO-PSYCHIC PERSONALITY TO CARCINOMA

(A) Variable Carcinogenic or Neoplastogenic Factors operating in the Individual Personality

These include the following:

1. *The Age Factor.* The liability of an individual to acquire carcinoma is partly determined by his age. The data of Lumsden and Dauer¹⁰ in respect of Massachusetts, Connecticut, New Jersey and Virginia for the period 1931-34 show that for both sexes the liability to acquire carcinoma rapidly increases after the age of 30 years; that in males this liability is about 5 times higher in the 50-60 year age-group, 11 times higher in the 60-70 year age-group, and 20 times higher in the group 70 years and over, than in the 30-50 year age-group. Generally speaking, the greater the proportion of old people in a population, the greater will be the percentage of cancer deaths in total deaths.

2. *The Factor of Sex.* The liability to cancer and other malignant tumours is partly determined by sex. Thus, in an European population, the male sex is generally less liable to neoplasia than the female sex. This phenomenon is amply reflected in the medical statistics of the United Kingdom for the years 1938-48. On the other hand, the male sex is more liable than the female sex to neoplasia of certain organs and tissues of the body. Thus for the year 1948 in England and Wales the incidence of neoplasia of the buccal cavity was 3.5 times higher in men than in women; that of the digestive organs and peritoneum 1.1 times higher; that of the urinary organs 1.9 times higher; and that of the skin 1.2 times higher; but, on the other hand, the incidence of neoplasia of the breast was 124.5 times higher in the female than in the male.

Strachan's data¹² indicate that in the Bantu the liability to carcinoma is slightly greater in the male than in the female but the position is reversed for the two sexes in regard to sarcoma and cerebral tumours.

3. *The Factor of Race.* The liability of an individual to acquire carcinoma depends partly on his racial status. Thus, according to Strachan's Johannesburg study, the incidence of neoplasia in the Europeans is 3.4 times higher than in the Bantu, while in the Eurasian race it is only 1.2 times higher than in the Bantu. The liability to neoplasia varies among the pigmented races

* A paper presented at the South African Medical Congress, Pretoria, 1955.

themselves. This fact has been established by Berman² from an analysis of statistics accumulated by Hoffman.⁷

4. *The Factor of Heredity.* The part played by heredity in the transmission of human cancer cannot be determined with any degree of accuracy. In any case, the term 'inheritance of cancer' is somewhat dubious, for what is inherited is not cancer as such, but an increased susceptibility to cancer. It is accordingly preferable to speak of the 'familial incidence' of cancer. Heredity *per se* does, nevertheless, play a part in determining the frequency of cancer in various parts of the body.⁴

5. *The Endocrinologic Factor.* The importance of the endocrine secretions to the development and functioning of the body in general and of cancer in particular has been elaborated by Little.⁹ The relation of the sex glands to cancer forms the basis for much present research. Further, biological and biochemical research is yielding significant information about the relationships of cancer to the other glands of internal secretion, such as the pituitary, the adrenals, the thyroid, and the spleen.⁹

6. *The Factor of Nutritional Status.* The liability to cancer is partly determined by the nutritional status of an individual. Thus, Dr. Louis Dublin, chief actuary of the Metropolitan Life Insurance Company, has shown that the cancer death rate increases as weight increases.¹³

7. *The Factor of Morbidity.* The liability of an individual to carcinoma may be determined by certain infections like syphilis, tuberculosis and bilharzia and, generally, by certain diseases of the liver, endocrines, stomach etc. associated with regenerative hypertrophic lesions. The claims made by many pathologists that viruses are the cause of certain types of malignancy in human beings may, in the view of the writer, be difficult to accept on methodologic grounds; for it could be logically postulated that they are the effect rather than the cause of malignancy. In any event, viruses and organisms like pneumococci, tubercle bacilli etc. are constantly present in the human organism, but not all human beings contract malignancy, pneumonia or tuberculosis, as the case may be. Therefore, if viruses are a factor in malignancy, they only become so when they are activated by a set of other factors acting collectively and interdependently, and the operation of which is initiated by a disorganizing *noxa* which may *ab initio* be physical or psycho-physical in character.³

8. *The Factor of Occupational Status or Environment.* The liability of an individual to carcinoma depends partly on the occupational environment to which he is exposed. The known or suspected extrinsic carcinogens have been listed by Hueper⁸ as (a) direct primary carcinogens, (b) indirect primary carcinogens, (c) indirect secondary carcinogens.

9. *The Factor of Economic Status.* Stevenson¹¹ has shown that the liability to carcinoma of certain organs varies in the different social classes.

10. *The Factor of Urbanism.* Living in a city with a high population-density increases the liability of an individual to carcinoma.¹⁴

11. *The Factor of Psychologic Status.* The part played by the psychologic status of an individual in determining liability to neoplasia invites attention, especially insofar as the human personality is universally an expression of the body-mind interaction process operating within the multiform surround. The author would postulate in the light of this concept that any emotional change, whether engendered *ab extra* or *ab intra*, is accompanied by a specific biochemical substance which is poured into the blood stream and carried to every organ and tissue of the body and has a specific effect upon the organs and tissues of the body; and that the nature of the biochemical change varies with the type of emotional experience. In the main, the diverse emotions experienced by the human personality may be classed into two fundamental divisions, namely (i) those which conduce to well-being or harmonic adjustment on the psycho-physiologic plane of experience, and (ii) those which conduce to ill-being or disharmonic adjustment. The former group of emotions include love and mercy, humility and kindness, compassion and forbearance, based upon sociologic understanding which induce what we have termed a *dilatation of the channel of consciousness*, whereby the area of the mind's contact with reality becomes widened, and wherein the *dilator effects* of such emotions are instantaneously transmitted from the psychic segment to the vascular elements

in the somatic segment of the personality. The group of emotions which conduce to ill-being or disharmonic adjustment are the diametric opposites of the first; and they include hatred, cruelty, arrogance, intolerance and aggressiveness, which induce what we have called a constriction of the channel of consciousness, whereby the area of the mind's contact with reality is diminished, and wherein the *constrictor effects* of these emotions are instantaneously transmitted from the psychic segment to the vascular elements in the somatic segment of the personality, producing therein—as psycho-physiological experiments prove—actual constriction of the arterial vessels. The group of emotions which produce a 'dilator effect' within the psycho-somatic personality we designate as '*psycho-dilator stimuli*', and those which produce constrictor effects we designate as '*psycho-constrictor stimuli*'. Now the arterial constriction produced by the psycho-constrictor stimuli (*ab extra* or *ab intra* with reference to the personality) causes an interference with the blood supply to the organs and tissues, eventually tending to degenerative changes within them. But the affected organs and tissues, like the total human personality, do not want to die, and they essay to save themselves, i.e. to intergrate themselves into a harmonic physiologic whole; and this they do by a process of cellular hypertrophy on the part of the surviving cells, which is a compensatory process, i.e., an integrational process. The integrational impulse, i.e. the urge to live as an integrated whole, is present not only within the psyche, but also within every cell of the living organism. But the degenerative change in the affected cells may be so rapid and acute as to threaten the life of the remaining cells; and these cells, in a bid to save themselves collectively, will undergo excessive cell division without reference to the structural requirements of the organ as a whole. Such cellular activity, which serves no useful functional purpose, is thus an over-compensatory process, replacing one pattern of cellular disorganization by another which is worse. But this cellular over-compensatory process, in so far as it is evoked by nutritional deprivation of other cells, is fundamentally not dissimilar in character to the psychologic over-compensatory process which occurs in the human personality as a reaction to emotional deprivation or frustration. In so far as this is so, deprivation or frustration on the psychosocial plane of experience, must induce certain biochemical changes within the body which in turn evoke an over-compensatory process, i.e., a neoplastic process, or a 'splitting off', or schizosomatic process affecting the cells of a particular organ or tissue. If this is true, and it may conceivably be so, then the whole question of cancer cannot be construed as a somatic problem, but rather as a psycho-sociological problem capable of resolution only by the elimination of the variables in our society which make for undue frustration and deprivation on the fundamental planes of human experience.⁶

(B) Variable Carcinogenic or Neoplastogenic Factors operating in the Individual's Physical Environment

These include the following:

- (1) Industrial or Occupational Carcinogens.¹
- (2) The Factor of Sunlight.

II. VARIABLE FACTORS OPERATING IN THE MULTIFORM ENVIRONMENT WHICH DETERMINE THE INCIDENCE OF CARCINOMA IN A COMMUNITY

In the light of the foregoing analysis of the carcinogenic factors which inhere in the individual somato-psychic personality, it is clear that the variable factors within the multiform environment which determine the incidence of carcinoma in a community must include the items 1-3 and 6-11 of the factors included under (A) above. That is to say, the incidence of carcinoma in a population will be greater (1) the greater the proportion of aged persons, (2) the higher the masculinity, (3) the greater the proportion of Europeans, (4) the greater the number of malnourished persons, (5) the greater the incidence of syphilis, tuberculosis and bilharzia,

(6) the greater the proportion of persons engaged in occupational activities which bring them into close and prolonged contact with extrinsic carcinogens, (7) the greater the poverty, (8) the greater the degree of urbanization, and (9) the greater the number of mentally disordered persons.

THE CONTROL OF NEOPLASIA

Our method of control of neoplasia must necessarily be determined by our acceptance of the conception of man as a body-mind-surround unit, which the neoplastic individual also is. In so far as this is true, control measures in a community must be applied to each element of the integrate—both to the affected psycho-somatic personality, and to the environment in which that personality is projected. Thus the measures of control must necessarily embrace the following:

1. *Medical measures*, applied to the individual.
2. *Medico-social measures*, applied both to the individual and the group, and including (a) cancer legislation, and (b) cancer education.
3. *Medico-sociological measures*, which are necessarily directed to the variable carcinogenic factors which operate in the multiform environment and must have as their objective the elimination or the amelioration or the normalization of these factors in the population. Thus these measures involve (a) the amelioration of the nutritional status, (b) the

eradication of syphilis, tuberculosis, and bilharzia, (c) the provision of a hygienic occupational environment, and (d) the amelioration of economic conditions, etc. etc.

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THE SURGICAL REPAIR OF THE SOUND-CONDUCTION APPARATUS*

WITH SPECIAL REFERENCE TO MOBILIZATION OF THE STAPES

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Johannesburg

Deafness is possibly the commonest disability of mankind, affecting all races and ages. Yet until the past few decades it was an affliction for which little could be done. There was much truth in the cynicism that deafness could be divided into two classes—that due to wax, and the incurable.

The present position is that nerve or perceptive deafness still defies the best efforts at amelioration. In many cases hearing aids are able to give sufficient help to ensure social and economic rehabilitation but medical or surgical cure is still an improbable dream of the future.

Conductive or middle-ear deafness has, however, gradually succumbed to the efforts of generations of aural surgeons, to such an extent that a majority of such cases of deafness can be successfully treated by surgical means. The post-war years have seen great strides made in the surgical repair of defects of the mechanism of sound-conduction.

Conductive deafness falls largely into two groups, caused by either chronic infection or otosclerosis:

1. Lesions caused by chronic infection

This results in perforation of the ear drum or erosion of portion of the ossicular chain together with chronic inflammatory obstruction of the oval and round windows and the

Eustachian tube. As I have previously described in greater detail,¹ by means of microsurgical techniques called tympanoplasty the ossicular chain is reconstituted and granulations removed from the windows and Eustachian tube. The superficial epithelium is removed from the ear drum, exposing the fibrous matrix. This acts as a bed for the skin graft which is applied to cover the perforation and much of the operation cavity. One is able to restore an enclosed air-containing middle-ear cavity with an intact vibrating ear drum and a functioning sound-conducting mechanism. In 75% of cases it is possible to improve hearing to a serviceable level and often to near normal levels. The restoration of hearing is permanent and is accompanied by elimination of infection and closure of the perforation, resulting in a dry ear. One can foresee the time when tympanoplasties will constitute a very large proportion of surgical procedures for chronic otitis media. The technique requires special instruments and patience and ability to work for long periods under $\times 10$ or $\times 16$ magnification. Aural surgery owes a great debt to the pioneers of this technique from 1952 onwards—Professors Wullstein, Zöllner and Pietrantoni, at whose clinics I acquired first-hand information early last year.

2. Otosclerotic Deafness

This disease manifests itself by the deposition of new pathological bone in the labyrinth capsule. When this bone

* A paper presented at the South African Medical Congress, Durban, September 1957.

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is laid down in the region of the oval window it joins the anterior edge of the foot-plate of the stapes to the margin of the oval window. This results in a lack of mobility of the stapes so that sound-waves are not freely transmitted to the inner ear. The deafness which is thereby caused is of course conductive, so that bone conduction is better than air conduction. The ear drum remains perfectly normal in appearance. As a rule, the disease first begins in adolescence, it is often familial and it is aggravated by pregnancy in 30% of cases in women. The process is progressive, so that a hearing aid gives decreasing help as the years go by.

The obvious point of attack was the foot-plate of the stapes. In 1876, Kessel attempted to restore the mobility of the foot-plate. He was followed by many others but early in this century these efforts were abandoned owing to unsatisfactory results. These were obviously due to lack of electronic audiometers for accurate tests of the hearing, poor illumination and magnification, and the absence of antibiotics to control infection and adhesions.

Subsequently Holmgren, Sourdille, and finally Lempert, devised methods of making a new oval window, the fenestra nov-ovalis, on the horizontal semicircular canal. This was covered with a free or attached skin graft. The sound-waves then by-passed the ear drum and ossicular chain and entered the inner ear directly through the new oval window. This procedure, fenestration, has been a most satisfactory operation. With improved technique serviceable hearing is restored in about 70% of cases. Few cases now relapse owing to closure of the fenestra. The operation, however, is quite a formidable one for the patient. He has to remain in hospital for over a week, suffers from giddiness for a couple of weeks, especially for the first few days, and has to attend for dressings for a period up to 4 weeks from the time of operation. Later the patient should not swim, should avoid sudden loud noises, and in some cases may have intermittent discharge from the operation cavity.

Rosen² revised the old discarded attack on the fixed stapedial foot-plate, using a transmeatal approach devised by Lempert³ to expose the middle-ear cavity. The basic Rosen stapes-mobilization technique has since been modified and is extensively used by otologists throughout the world. At the International Otological Congress in Washington in May 1957 no fewer than 28 papers described experiences with this technique.

My personal experience is limited to the period from May 1956, and at the time of writing constituted a series of 64 cases. I shall describe the technique and then discuss my results.

TECHNIQUE OF MOBILIZATION

The patient has an audiogram curve of hearing by air and bone conduction, and his hearing for the whispered or spoken voice is also ascertained.

One hour before operation the patient is given an injection of 100 mg. of pethidine with 1/150 gr. of scopolamine, varied according to build and other factors. Local anaesthesia is produced by an injection of less than 2 c.c. of 4% procaine with epinephrine by means of a cartridge-type dental syringe. The injection is made by inserting a fine needle down to bone in the posterior-superior part of the entrance of the external auditory meatus. One can observe the solution

infiltrating the skin of the meatus and finally the drum itself. A small supplementary injection is given postero-inferiorly.

From this stage one uses the Zeiss binocular operating microscope, operating through a wide-mouthed black aural speculum. An incision with a specially angled knife is made through the meatal skin from 5 o'clock (or 7 o'clock) to 12 o'clock, 5-6 mm. from the edge of the ear drum. The skin is carefully elevated forwards to the annulus tympanicus. The ear drum is then lifted out of the sulcus and turned forwards, exposing the posterior half of the middle ear. The chorda tympani nerve may have to be pushed out of the way but should not be severed. By means of a small curette or diamond drill a small portion of the bony margin may be removed postero-superiorly to give better visualization of the middle-ear structures. One can now see the round window niche, the long process of the incus and portion of the head of the stapes with the stapedius tendon extending backwards from the stapedial neck. Portions of the crura and the foot-plate of the stapes may be seen. At this stage I test the hearing for whispered or spoken voice.

Mobilization of the stapes is now attempted. A curved fenestration needle is applied to the anterior aspect of the head of the stapes and pulsating pressure is applied backwards in line with the axis of the stapedial foot-plate. This corresponds with the direction of the tendon of the stapedius muscle. The latter can easily be seen attached to the posterior aspect of the neck of the stapes. Often there is a sudden feeling of free mobility in the stapes, which had previously been firmly fixed. It will also be found that mobility is free in an infero-superior direction. If the hearing is tested there will be a dramatic improvement.

If mobility cannot be restored, the needle is applied to the head and pressure is made in an infero-superior direction, i.e. towards the vertex and also in the oblique axis. Lastly the needle may be used directly on to the anterior and inferior edge of the foot-plate of the stapes. Such manoeuvres may free an obstinately fixed stapedial foot-plate. A freely mobile stapes can be moved about like a cork floating in water. During manipulation of the stapes in successful cases, transmitted movement can be observed in fluid in the round-window niche.

When one is satisfied that the mobility achieved cannot be improved, blood is sucked out of the tympanum with a needle suction tip. The round-window niche is inspected and cleaned of adhesions, which are occasionally encountered. The drum with its attached cuff of meatal skin is replaced and gently kept in apposition to the meatal wall with small pieces of spongostan. The meatus is occluded with a light cotton-wool plug and a dressing applied over the ear. The patient is discharged from hospital on the following morning and given an oral antibiotic for the next 4 days. Nose-blowing and air travel are prohibited for 5 days.

Post-operative pain is unusual, whilst giddiness has not been experienced in any of my cases, except for a few hours after operation. A post-operative audiogram is obtained 5 weeks after operation.

Complications of Stapes Mobilization

Fracture of the crura may occur before the foot-plate is mobilized, resulting in failure of the operation. Dislocation of the incus is of no importance and is occasionally performed deliberately so that the mobilization needle can be applied

directly to the exposed external surface of the head of the stapes. If the incus is replaced in its normal position there are no harmful effects.

Transient facial paralysis has occurred in 2 cases, recovering completely within 8 hours. Such paralysis is due to infiltration of the facial nerve with the local anaesthetic solution, presumably along the chorda tympani. Perforation of the ear drum has occurred in some early cases, but has healed completely within the first week.

DISCUSSION OF RESULTS

In my opinion, in the present state of our knowledge of otosclerotic deafness, mobilization should be advised in all cases.

In early cases, with a hearing loss in the vicinity of 30 decibels, fenestration is not practical as the hearing improvement is too little to warrant such a formidable ordeal. Mobilization, however, can restore hearing to near the normal level, by means of what is an essentially minor operation. Advanced cases with secondary cochlear degeneration, have generally a poor prognosis with fenestration. A successful mobilization can offer hope of serviceable hearing with a negligible risk of further cochlear deafness.

If mobilization fails, fenestration can be performed within a few weeks. The operation is no more difficult than in

cases which have undergone no previous operative interference.

In one case, owing to the insistence of the patient, I performed a second mobilization after failure at the first attempt. The result was highly successful. This case required direct manipulation of the anterior edge of the foot-plate of the stapes.

It must be stressed, in conclusion, that the great majority of the successful cases have been easily mobilized. One of my best results was obtained in a case in which the operation lasted only 15 minutes.

RESULTS

Out of a total of 64 cases in which I have performed stapes mobilization, 22 cases have reached a hearing level of 30 decibels loss, or better, in all three frequencies of the speech-hearing range. An additional 5 cases have reached a level not lower than 35 decibels loss in one or two of these frequencies. Thus a total of 27 cases (42%) have had what can be regarded as a highly successful result. Finally, several cases not included in the above figures have shown improvement ranging from 17 to 27 decibels, but have not attained a level of 35 decibels loss.

Particulars of the 27 successful cases are given in the following table:

Date of Operation	Name	500 c/s		1,000 c/s		2,000 c/s		Average gain (decibels)
		pr.*	po.*	pr.	po.	pr.	po.	
20 Jun. 1956	Mrs. J.	50	30	50	30	55	30	22
30 Oct.	Mast. A.H.	40	30	40	25	40	30	12
4 Dec.	Miss Z.J.	50	20	50	25	35	30	20
6 Dec.	Mrs. H.W.	45	25	45	25	35	25	17
1957								
23 Feb.	Mrs. J.E.W.	40	15	45	15	35	10	26
5 Mar.	Mr. T.G.W.	35	15	35	15	40	15	21
14 Mar.	Mrs. P.v.d.M.	35	10	40	15	45	20	25
16 Mar.	Mrs. J.F.W.	65	20	80	20	70	25	50
9 Apr.	Mrs. McD.	45	25	40	20	40	20	20
22 Apr.	Mrs. M.J.M.	55	25	60	30	55	15	35
25 Apr.	Mr. P.J.	40	20	35	20	30	15	17
30 Apr.	Mrs. D.F.	55	30	60	35	60	30	25
23 May	Mr. I.M.	35	20	45	25	40	30	15
13 Jun.	Mr. S.C.	50	20	45	20	60	20	30
13 Jun.	Mrs. B.T.	50	15	45	15	35	10	30
20 Jun.	Mr. J.B.	45	25	45	30	45	35	15
20 Jun.	Mrs. J.J.L.	50	30	55	35	55	30	20
9 Jul.	Mrs. M.v.N.	45	20	50	35	40	30	17
11 Jul.	Mrs. N.K.	45	15	55	25	50	20	30
22 Jul.	Mrs. E.J.B.	45	35	50	35	50	30	15
8 Aug.	Mr. A.M.B.	45	15	45	25	50	20	26
9 Aug.	Miss S.J. (second ear)	45	20	45	20	30	15	21
28 Sept.	Mrs. P.v.d.M. (second ear)	40	0	45	10	55	15	38
4 Oct.	Miss A.D.	35	30	40	30	40	25	10
15 Oct.	Mrs. V.S.	40	25	40	25	35	15	17
17 Oct.	Mrs. P.L.	40	20	45	20	35	20	20
24 Oct.	Mr. J.C.B.	45	20	50	30	40	20	21

* pr. = pre-operative. po. = post-operative.

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OFFICIAL ANNOUNCEMENT : AMPTELIKE AANKONDIGING

MEDICAL AID SOCIETIES : MEDIESE HULPVERENIGINGS

From time to time enquiries are made by members of the Association with regard to their attitude towards members of approved medical aid societies. Reference to this question was made in a footnote to a letter which appeared in the correspondence columns of the *Journal* of 26 October 1957 (p. 1104) and in a letter which appeared in the *Journal* of 23 November 1957 (p. 1212). It appears advisable that the position should be set out clearly again for the information of the members of the Association.

The Medical Association has made an agreement with medical aid societies that the Tariff fees shall be applied when members of the Medical Association treat members of approved societies. Generally speaking, members of the Medical Association accept members of medical aid societies for treatment at the fees laid down in the official tariff. In such cases, if the practitioner accepts payment from the society and the society sends the full amount of his account, this payment is to be deemed to be in full settlement of the account. It would be entirely irregular for the doctor to send an additional account to the patient for the difference between the medical aid tariff and the charges made to private patients.

There is, however, no compulsion on a member of the Medical Association to accept the medical aid tariff, but then he should not treat any patients at all at the tariff rate. In other words, he should not differentiate between which members of a medical aid society he will treat at tariff rates and which he will treat at private rates. The medical practitioner must inform his patients at their first visit if he does not accept the medical aid tariff, so that they will understand that they are regarded as private patients and will be directly responsible to the doctor for his account. In such cases any responsibility of the medical aid society for payment of the doctor ceases.

The society is, however, still responsible to its member for the benefit due to him, and the doctor should give a detailed account so that the member may receive his benefit from the society. The patient either pays the doctor and forwards his receipted account to his society for a refund of the amount of his benefit or sends in his claim, collects the benefit from the society and pays the doctor direct, adding whatever portion of the account he is liable for. If, in the latter instance, the society instead of paying the benefit to the member, decides to send the doctor an amount equal to the medical aid rates for the services rendered, the doctor's acceptance of that cheque in part payment cannot be interpreted as an acceptance on his part of medical aid rates in full settlement of the account, and he is therefore entitled to collect the remainder of the account from the patient. This is, of course, all subject to the patient's being aware of his position as a private patient *vis-a-vis* the doctor.

L. M. Marchand
Associate Secretary

Medical House
35 Wale Street
Cape Town
10 January 1958

Telkens kom daar navrae van lede van die Vereniging in verband met hul verhouding tot lede van goedgekeurde mediese hulpverenigings. Die saak was aangeroei in 'n aantekening onderaan 'n brief wat in die korrespondensiekolom van die *Tydskrif* van 26 Oktober 1957 (p. 1104) verskyn het. 'n Verdere verwysing daarna het in 'n brief in die *Tydskrif* van 23 November 1957 (p. 1212) verskyn. Dit kom voor asof dit raadsaam sou wees om, vir algemene inligting van lede van die Vereniging, die posisie weer duidelik uiteen te sit.

Die Mediese Vereniging het 'n ooreenkoms met die mediese hulpverenigings getref dat die tariefgelde toegepas sal word wanneer lede van die Vereniging lede van goedgekeurde hulpverenigings behandel. Oor die algemeen neem lede van die Mediese Vereniging lede van mediese hulpverenigings vir behandeling aan teen die gelde soos in die offisiële tarief neergelê. In sodanige gevalle, as die geneesheer betaling van die hulpvereniging aanneem en dié vereniging die volle bedrag van sy rekening aanstuur, moet hierdie betaling as volle vereffening van die verskuldigde rekening beskou word. Dit sou geheel en al onreëlmatig wees vir die dokter om 'n bykomstige rekening na die pasiënt te stuur vir die onderskeid tussen die mediese hulpfondstaries en die bedrag wat van 'n private pasiënt geëis sou word.

'n Lid van die Vereniging is egter nie gedwonge om die tarief vir mediese hulpverenigings te aanvaar nie, maar dan behoort hy geen pasiënte hoegenaamd teen daardie tarief te behandel nie. Met ander woorde, hy behoort nie te onderskei tussen watter lede van hulpverenigings hy teen vermeldde tarief en watter lede hy teen die gewone gelde vir private pasiënte sal behandel nie. Die geneesheer moet sy pasiënte by hul eerste besoek in kennis stel as hy nie die mediese hulptarief aanvaar nie sodat hulle kan verstaan dat hulle as private pasiënte beskou word en direk aan die dokter vir sy rekening aanspreeklik sal wees. In sodanige gevalle vervel enige verantwoordelikheid van die hulpvereniging vir die betaling van die dokter.

Die hulpvereniging is egter nog aanspreeklik teenoor sy lid vir die voordeel wat die lid toekom, daarom behoort die dokter 'n rekening met besonderhede te verskaf sodat die lid sy toekenning van sy vereniging kan kry. Die pasiënt kan dan of die dokter eers betaal en sy voldane rekening na sy vereniging stuur om die deel wat hom toekom van die vereniging terug te kry, of hy kan eers sy eis by sy hulpvereniging inlewer, die bedrag wat die vereniging toeken ontvang, die deel van die rekening waarvoor hy verantwoordelik is daarby voeg en so die dokter ook direk betaal. Indien, in die laaste geval, die hulpvereniging sou besluit om, in plaas van die toekenning aan die lid te betaal, die dokter 'n bedrag te stuur wat bereken is volgens die mediese hulpverenigingstarief vir die gelewerde diens, kan die dokter se aanname van daardie tjek nie vertolk word as sou hy die mediese hulpverenigingstarief in volle vereffening van sy rekening aanvaar nie. Hy is derhalwe geregtig om die orige deel van die rekening van die pasiënt in te vorder. Dit alles is natuurlik onderhewig aan die pasiënt se bewustheid van sy posisie as 'n private pasiënt teenoor sy dokter.

L. M. Marchand
Medesekretaris

Mediese Huis
Waalstraat 35
Kaapstad
10 Januarie 1958

THIRD ANNUAL REPORT OF THE JOHANNESBURG HOSPITAL SURGICAL VASCULAR UNIT

The Saturday morning meetings of the Surgical Vascular Unit have continued with success under the chairmanship of Mr. A Lee McGregor during the year 1957. The following is an analysis of the proceedings of the Unit since the last report:

1. Case Presentations

Eighty-five cases were presented for discussion. The great majority of cases were well presented with complete investigations and usually supported by arteriograms. The technical performance

of the latter has been a feature of these meetings and the Radiology Department is to be congratulated on the excellence of the plates produced. The majority of cases presented were patients at the Johannesburg Hospital, but a good number were supplied by other hospitals, particularly the Baragwanath non-European Hospital. A few private cases of members were also shown.

Analysis of the cases reveals that the majority of the problems discussed were cases suffering from atherosclerotic conditions complicated by thrombosis, embolism or aneurysm formation.

The next most common topic of discussion was vascular trauma and traumatic aneurysms. Portal hypertension, deep-vein thrombosis, frost-bite, Buerger's disease, and Raynaud's phenomenon, were also subjects for case presentation.

2. Invitation Lectures

A number of these were delivered, as follows:

- (a) Mr. L. Stein on portal venography and portal hypertension in the Bantu.
- (b) Dr. M. Suzman and the late Dr. M. Peskin on carotid-artery thrombosis.
- (c) Mr. H. Gaylis on dissection of the aorta during aortography.
- (d) Dr. M. Denny on aortography and cerebral angiography.
- (e) Mr. R. Lipschitz on intracranial aneurysms.
- (f) Mr. I. Norwich on recent advances in arterial surgery seen on his tour overseas.
- (g) Mr. P. Theron on aortic bifurcation replacement grafts with presentation of a successful case.

3. The Artery Bank

This bank has suffered from a number of vicissitudes during the past year, and was almost declared insolvent! Mr. P. Marchand retired from the bank in June and the management was taken over by Mr. L. Stein, at the request of the Acting Head of the Department of Surgery. The usual source of supply of arteries has been cut off. However, by changing the previously used technique and by using betapropiolactone (BPL) for sterilizing the grafts the field from which arteries can be taken has been considerably widened; and more grafts have become available.

Eleven grafts have now been issued using the BPL technique and in no cases have any ill-effects due to this technique been found. The grafts themselves are now sterile and histologically and mechanically appear sound. Deep freezing of the grafts is being replaced by freeze drying.

L. Stein, F.R.C.S.
Secretary

MEDICAL RESEARCH IN AMERICA

AN ABSTRACT

Merck & Co. Inc., Rahway, New Jersey, have sponsored and published a survey of the present state of medical research in the USA made by Douglas Williams Associates, of New York. The survey concludes that for the first time in history American medical research is no longer starved for funds. There are, however, 'islands of poverty in the sea of plenty'. Stress is laid on the following points amongst others:

1. *Basic Research.* It is generally agreed that there is a need for more basic research. Millions of money, for instance, will be devoted to 'curing cancer', but there is public apathy about funds for the study of cell physiology. Many criticize the organization of research into disease categories (cancer, polio etc.).

Others, however, consider this approach the only way to raise large funds, and that these can be flexibly administered so as to assure support for basic research.

2. *Medical education* is being impoverished to enrich research. 'Topnotch people' are drawn away from teaching to research.

3. *'Brains are scarcer than dollars.'* Despite the availability of funds, there is a shortage of technicians, administrators, creative people and teachers. The number of creators in various fields of medical science is woefully limited—people with 'cock-eyed' rather than orthodox ideas. 'Orthodox ideas lead to nothing.'

4. *Role of Government.* Controversy is expressed about possible Government domination, and the relative parts to be played by Government, Universities and others.

PROTECTION OF WORKERS AGAINST RADIATION

A 'group of experts' appointed by the International Labour Organization to advise on this subject reported in December 1957. They laid stress on the imperative need for education of the workers in the field of radiation protection. Confusion was caused by sensational and contradictory news items in the popular press, and it was important to make personnel realize that, although ionizing radiations might present certain risks, the risks only appeared if irradiation exceeded maximum permissible dosage, and should not obscure the benefits humanity derive from the application of these radiations. The interest of trade unions should be stimulated.

The 'group' dealt chiefly with manufacturing operations which utilized unsealed radio-active materials, e.g. those concerned with luminizing, thickness gauges, level gauges etc. Luminizing is by far the most hazardous, and its risks compare unfavourably with those in the use of materials of similar toxicity in the atomic

energy industry, to which more stringent requirements apply. The 'group' is recommending to the ILO modifications of the 'Model Code of Safety Regulations for Industrial Establishments for the guidance of Governments and Industries', which were issued by the ILO in 1949. These modifications include 3 drafts, viz. (1) a general code for industrial radiation protection, (2) dealing with industrial radiography and fluoroscopy, and (3) dealing with the use of luminous compounds.

The 'group' deliberately restricted its discussions to these kinds of operations and gave no consideration to the hazards of the mining and refining of radio-active ores, the treatment of nuclear fuel after irradiation, nuclear reactors, high-energy particle accelerators, etc. These and other hazards they recommend for consideration by the ILO in the near future. They recommend that a clear distinction should be drawn between problems of public health and problems of occupational health and safety, the latter being incontestably within the competence of the ILO.

SIR ARTHUR SIMS COMMONWEALTH TRAVELLING PROFESSORSHIP

VISIT TO SOUTH AFRICA

The Professorship was endowed in 1946 by Sir Arthur Sims, a New Zealand industrialist, with business interests in New Zealand, Australia and England. The objects are the establishment of a close link between scientific workers in the Dominions and in the older seats of learning and centres of research, to benefit thereby the people of all nations and to make a contribution to Commonwealth unity. Each Professor is required to travel from

the country where he or she is ordinarily resident to Great Britain, Australia, New Zealand, Canada or South Africa for the purpose of assisting the advancement of medical science by lecturing, teaching or engaging in research. The duty is ambassadorial as well as academic. The appointment is made by the Council of the Royal College of Surgeons of England on the recommendations of an Advisory Board, which consists of Members from

the other Commonwealth countries. The Secretary of the Royal College of Surgeons of England acts as Secretary to the Board. The duties (i.e. the countries to be visited) and the emolument (normally £2,000) are stated at the time of appointment which, as from 1955, is normally made in March prior to the year of office. The time of year at which the tour is made, its exact duration (which should be about 3-6 months) and the centres to be visited within the stipulated countries, may be determined by each Professor in accordance with his own interests, aptitude and individual commitments. Nevertheless, the appropriate Royal College in each country must be consulted early and will usually give invaluable help in arranging itinerary, in organizing visits to hospitals and other institutions, and in booking accommodation and travelling tickets. Annual or other important meetings are sometimes arranged to coincide with Sims' Professors' visits. Newly-appointed Professors when planning their tours can get much useful guidance from the reports of their predecessors, copies of which can be obtained in most instances from the Royal College of Surgeons in London. The advisory board, as from 1953, in stating the countries to be visited expects that the tour can be financed out of the stated emolument of £2,000 without leaving the Professor out of pocket. The Professor is well advised to take his wife with him for she can render invaluable assistance in a secretarial capacity and in respect of many social commitments. The Professor is at liberty to use the emolument for his and her travelling expenses at his own discretion. In theory the emolument is subject to income tax but in practice it would probably prove to be used up in expenses and therefore tax is not actually payable. These directions in principle are given to Sims Travelling Professors before planning their tours.

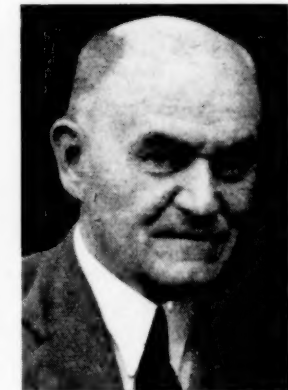
PASSING EVENTS : IN DIE VERBYGAAN

An Octogenarian Johannesburg Practitioner. Dr. Karl Friedrich Brenner, well known in Johannesburg as a colourful medical personality, celebrated his 80th birthday in December 1957.

Dr. Brenner was born in Osthofen, Germany, matriculated at Frankfurt-am-Main, started mathematics and natural science

at Strassburg, and took up medicine in the Universities of Freiburg and Heidelberg. He qualified in 1904 and became first assistant to the eminent pathologist, Eugen Albrecht, at Frankfurt, where he wrote a thesis on oophoroma folliculare, now known as the Brenner tumour. He afterwards devoted himself to clinical medicine and published a number of papers on clinical pathology, including one on haemangio-elastomyxoma cordis.

In 1910 Dr. Brenner came to Swakopmund, S.W.A. where he practised as a general practitioner and was also entrusted with official medical duties. This work took him to all parts of S.W.A., chiefly on horseback, and he published various



Dr. Brenner

papers, mainly on public-health conditions at the coast and on the diamond fields. From 1922 to 1935 he practised at Windhoek.

Since 1935 Dr. 'Fritz' Brenner has been well known as a general practitioner in Johannesburg, where he is regarded by his patients as a master of the 'old school'.

Dr. Adolph Meyer has retired from the radiological practice which he conducted in partnership with Drs. Latham and Tucker, at the Netherlands Bank Building, 85 St. George's Street, Cape Town.

Previous and present Arthur Sims Commonwealth Travelling Professors are as follows: 1948 Sir Hugh Cairns, *K.B.E.*, F.R.C.S., 1949 George White Pickering, F.R.C.P., 1950 Sir Reginald Watson Jones, F.R.C.S., 1951 Derrick Melville Dunlop, F.R.C.S.Ed., F.R.C.P., 1952 Edward Charles Dodds, *M.V.O.*, F.R.S., F.R.C.P., 1953 Harold Robert Dew, F.R.C.S., F.R.A.C.S. and Sir Charles Putnam Symonds, *K.B.E.*, *C.B.*, D.M., F.R.C.P., 1954 Sir James Rognvald Learmonth, *K.C.V.O.*, *C.B.E.*, F.R.C.S.Ed., Hon. F.R.C.S., 1955 Robert Inkerman Harris, *M.C.*, M.B., F.R.C.S. (Canada), Hon. F.R.C.S. and Donald Hunter, M.D., F.R.C.P., 1956 Sir Lionel Ernest Howard Whitby, *C.V.O.*, *M.C.*, F.R.C.P. and Sir Geoffrey Langdon Keynes, M.D., F.R.C.S., 1957 Sir James Paterson Ross, *K.C.V.O.*, F.R.C.S. and William Melville Arnott, *T.D.*, M.D., F.R.C.P., 1958 Prof. M. L. Rosenheim and Prof. R. M. Janes.

THE VISIT OF PROF. R. M. JANES

Prof. R. M. Janes, who will be arriving in South Africa as Sir Arthur Sims Travelling Professor on 22 February 1958 at Jan Smuts Airport, is emeritus Professor of Surgery at the University of Toronto. After some days in Johannesburg he will travel to Pretoria on 28 February and leave there on 7 March for Durban. He will be leaving Durban for East London on 13 March and will be in Port Elizabeth on 14 March. He will be arriving in Cape Town by 17 March and leaving on 26 March for Bloemfontein. He will be leaving the Union on 28 March. Professor Janes will be accompanied by his wife throughout his tour of the Union. His tour in South Africa has been arranged by the College of Physicians, Surgeons and Gynaecologists of South Africa.

The new telephone numbers of Dr. Selig Sacks (Drs. Sichel and Sacks, Ophthalmic Surgeons, National Mutual Chambers, Church Square, Cape Town) are: Rooms 23441 and 21629, residence 78042.

Research Forum: The next meeting of the Research Forum, University of Cape Town, will be held at Groote Schuur Hospital, Cape Town, in the A-Floor Lecture Theatre on Wednesday 29 January at 12 noon, when the subject will be 'The regulation of the serum-cholesterol level in normal active men: long-term effect of certain saturated and unsaturated fats and of other environmental variables', and the speakers will be Dr. H. Gordon and Prof. J. F. Brock.

Unie van Suid-Afrika. Departement van Gesondheid. Aangifte van ernstige epidemiese siektes en poliomiëlitis in die Unie gedurende die tydperk 3-9 Januarie 1958.

Poliomiëlitis

	Bl.	Nat.	Kl.	As.	Totaal
Transvaal ..	4	3	—	—	7
Kaaprovinsie ..	2	1	3	—	6
Oranje-Vrystaat ..	—	1	—	—	1
Natal ..	1	—	—	—	1
Totaal ..	7	5	3	—	15

Pes, Pokkies, Tifuskoors: Geen.

World Medical Association. The 12th General Assembly of the WMA will be held in Copenhagen, Denmark, on 15-20 August 1958, and member associations have been asked to submit the names of their delegations not later than 24 February. Information may be obtained from the Secretary General, WMA, 10 Columbus Circle, New York 19, N.Y.

The First Decade Report of the WMA is now available and may be obtained for \$2.00 (USA) from the Secretary General.

World Medical Periodicals. The second edition of *World Medical Periodicals*, published on 1 October 1957, is on sale at £1 10s. 0d. per copy. This book of 340 pages contains a list of nearly 5,000 titles of medical periodicals with the official contractions for their names, and with indexes under subjects and under countries of publication. The text is in English, French, German and Spanish. This work is indispensable to medical authors and journalists. The second edition has been prepared by Mr. L. T. Morton under the auspices of a Joint Committee (Chairman, Dr. Hugh Clegg) of the World Medical Association and the International Union of the Medical Press.

The 5th International Congress on Diseases of the Chest under the auspices of the American College of Chest Physicians, will be held in Tokyo, Japan, on 7-11 September 1958. The Japanese Government and Medical Profession are much interested in the success of the Congress, which will be the first of its kind to be held in the Asian continent, and the Japan Medical Association

pledges its support. The Japan Chapter of the College of Chest Physicians will be hosts of the Congress and extend an invitation to all members of the College to attend. The scientific programme will include formal papers, symposia, fireside conferences, motion-picture sessions, scientific and commercial exhibits, and visits to various medical institutions and hospitals. Tours will be arranged to scenic beauty-spots and points of interest characteristic of Japan. A special programme for visiting ladies will be arranged including fashion shows, flower arrangement, a tea ceremony, and Takarazuka Theatre. A post-Congress tour to Hongkong, Bangkok, Manila and Hawaii is planned by College chapters. Members of the College are requested to fill in the questionnaires recently sent out by the College office in Chicago. The Secretary General of the Congress is Jo Ono, M.D., School of Medicine, Keio University, 35 Shinanomachi, Shinjuku, Tokyo. Information may be obtained from Dr. D. P. Marais, Southern Life Buildings, St. George's Street, Cape Town, Regent of the College for South Africa.

REVIEWS OF BOOKS : BOEKRESENSIES

ANALGESIA IN CHILDBIRTH

Inhalation Analgesia in Childbirth. By E. H. Seward, M.A., D.M. (Oxon.), F.F.A.R.C.S., D.Obst. R.C.O.G. and R. Bryce-Smith, M.A., D.M. (Oxon.), F.F.A.R.C.S. Pp. viii + 58. 11 Figures. 7s. 6d. Oxford: Blackwell Scientific Publications. 1957.

Contents: Introduction. 1. The Pain of Labour. 2. The Basis of Pain Relief. 3. Intermittent Inhalation Analgesia. 4. Conduct of Analgesia. 5. Nitrous Oxide. 6. Trichlorethylene. 7. Analgesia with Trilene. 8. Comparison of Trilene and Nitrous Oxide. 9. Contra-Indications. 10. Causes of Failure. 11. Nitrous Oxide/Air Apparatus. 12. Trilene/Air Apparatus. Appendix I. The Testing of Gas/Air Machines. Appendix II. Specifications for Trilene Inhalers. Appendix III. C.M.B. Rules Relating to Analgesia. Index.

This is a new publication intended primarily for midwives which will also be of value to obstetricians, particularly those concerned with the teaching of midwifery students, and of interest to all anaesthetists.

It is a concise, well-written book with adequate diagrammatic illustrations. In these days when so much is written on 'Natural Childbirth' and hypnosis it is pleasing to have a guide to the use of well-known and well-tried analgesic drugs, which are of general application and which can be expected to give relief to almost every co-operative parturient woman.

The use of drugs given by injection and inhalation are both well presented. It is to be hoped that the day is not far distant when every maternity home will be provided with at least one piece of analgesic apparatus which is in working order and in constant use. This will ensure that midwives will pay attention to the details which are so essential to success. So often one finds that a piece of apparatus is condemned simply because those concerned are not prepared to go to the trouble of learning about its capacities and limitations and this book should fill a real need with respect to analgesic apparatus in obstetrics.

C.F.

SIR GEORGE BUCKSTON BROWNE

Sir George Buckston Browne. By Jessie Dobson, B.A., M.Sc. Pp. viii + 143. Figs. 28. 25s. net plus 11d. Postage abroad. Edinburgh and London: E. & S. Livingstone Ltd. 1957.

Contents: Preface. I. Introduction. II. Henry Browne of Manchester. III. George Buckston Browne. IV. Student Days. V. Private Practice with Sir Henry Thompson. VI. George Buckston Browne and His Patients. VII. Holidays and Recreation. VIII. Activities in Retirement. IX. Down House. X. The Buckston Browne Research Farm. XI. The Last Years. XII. Sir Buckston Browne as a Surgeon—An Appreciation. By Sir Hugh Lett, K.C.V.O., C.B.E., F.R.C.S. Sir George Buckston Browne's Publications. Index.

This is an autobiography within a biography and as such provides a very complete picture about a remarkable man. The story unfolds to give a clear insight into the character which together with unremitting hard work and attention to detail made him one of the leading urinary surgeons of his day. The passages relating to London consulting practice in Victorian times, the Down House and the Buckston Browne Farm are especially interesting.

This book should be read by all those interested in the histories of medicine, urology and the Royal College of Surgeons.

R.S.

PERIPHERAL CIRCULATION IN HEALTH AND DISEASE

Peripheral Circulation in Health and Disease. By Walter Redisch, M.D., F.A.C.P. and Francisco F. Tanco, M.D., B.S. with a special selection by R. L. de C. H. Saunders, MD., F.R.S.E. Pp. + 154. 25 Plates. \$7.75. New York: Grune & Stratton. 1957.

Contents: Preface. Introduction. Part I. Basic Aspects of Peripheral Blood Flow. Part II. Pathologic Alterations in Peripheral Blood Flow. Part III. Physiologic Responses to Disturbances in Blood Flow. Part IV. Management and Therapy. Part V. The Anatomic Basis of the Peripheral Circulation in Man. Index.

This little volume of 132 pages contains an unusually well-organized survey of the known facts pertaining to peripheral vascular disease and the treatment thereof.

In part one the peripheral vascular anatomy and the factors governing blood flow are described. The concept of vasomotion, and the mechanism involved are critically reviewed. There follows a chapter on the clinical approach, together with the more specialized manoeuvres used to evaluate blood flow in the extremities. Part two deals with the underlying pathology and the essential outlines of the disease entities in this field. Part three is devoted to the physiological adjustments attending on acute and chronic vascular occlusive processes. Part four presents an up-to-date summary of the medical and surgical measures available in the management of these conditions.

The final section by Dr. R. L. de C. Saunders and his associates incorporates their recent original work on the finer vascular supply to muscle, mainly in man. Using stereo-microangiography and radio opaque media with particles no larger than red blood corpuscles, they demonstrate the vascular pattern down to capillary level. Their findings are factual and illuminating. The quality of illustrative photographic reproduction is superb throughout.

This book offers interesting reading and rewarding study to wide sections of the medical profession

J.D.S.

HAEMOLYTIC DISEASE OF THE NEWBORN

Die Pathogenese Des Morbus Haemolyticus Neonatorum. Von Priv. Doz. Dr. Gerhard Martius. Pp. 70. DM 9.60. Stuttgart: Georg Thieme Verlag. 1956.

Inhaltsübersicht: I. Geschichtliches zur Pathogenese des Morbus haemolyticus neonatorum. II. Bisherige Untersuchungen über den Antigen-Antikörper-Austausch zwischen Frucht und Mutter. III. Zur Methodik des Antigennachweises. IV. Eigene Untersuchungen zur Frage des Antigenvorkommens im Plazentargewebe. V. Untersuchungen zur Frage des Antigenvorkommens im Blutsrum. VI. Histologische Untersuchungen von Plazenten erythroblastischer Kinder. VII. Besprechung der Ergebnisse. VIII. Zusammenfassung. Literaturverzeichnis.

This book has great statistical significance. The author gives a very interesting resumé of the years and work done prior to the

eventual discovery of rh-factors. It also describes in great detail the various methods employed in tracing the causative factor of haemolyticus neonatorum. It discusses the histological pattern which is usually encountered in such placentas in conjunction with the haemopoietic imbalance noticed in these new-born babies. Diapedesis, oedema, necrosis, and haemorrhage are responsible for the macroscopical changes seen at birth. The placenta *per se* is thought not to participate in the act of rh-sensitisation.

The experimental findings are tabulated in a practical and well-controlled manner, and are easy to follow. The author discusses the influence of haptens and its important role in primary sensitization, with the resultant clinical abnormalities which occur with the next pregnancy. The antigen/antibody reaction in the placenta is considered to occur intravascularly, and the macroscopic changes are thought to be a sequel.

The author concludes with a summary of the different chapters followed by a discussion and interpretation of the aforesaid experimental findings.

D.J.H.

THE MALABSORPTION SYNDROME

The Malabsorption Syndrome. Edited by David Adlersberg, M.D. Pp. iii + 252. Figures. \$5.50. New York and London: Grune & Stratton, Inc. 1957.

Contents: Foreword. Introduction. The Physiology of Intestinal Absorption. Disturbances in Protein and Lipid Metabolism. Water and Electrolyte Upsets. Alterations in Vitamin B₁₂ Absorption. Pancreatic Secretion Studies. Pathologic Studies. Biopsies of the Small Intestine. Clinical Aspects. Blood and Bone Marrow Manifestations. Haemorrhagic Manifestations. Neurologic Manifestations. Osseous Changes and Fractures. Roentgen Findings. Management. Malabsorption Following Extensive Small Bowel Resection. Index.

This rather unusual monograph is virtually a reprint of a recent issue of the Bulletin of the Mount Sinai Hospital of New York. It is a series of collected articles by staff members of that hospital, each set of articles utilizing in general, but not entirely, the same set of patients. Dr. Adlersberg is the chief author and 'editor' of the volume, but there seems to have been little attempt to produce continuity of thought or uniformity of terminology. (For instance the terms 'sprue' and 'osteoporosis' are given different connotations in different chapters). It seems to the reviewer that good individual articles are one thing, but an easily comprehended book or monograph is quite another. The very subject of the work is in doubt—plainly the main subject being what we call 'idiopathic steatorrhea'. Some authors keep to this subject solely, others discuss also tropical sprue, even post-gastrectomy states, ulcerative colitis, pancreatitis, ileitis, and other malabsorption syndromes. The last chapter purports to introduce and discuss an entirely different topic—that of massive resection of the small gut, but it gets all mixed up with exclusions, regional enteritis and so on. Surely it would have been better to consider in detail the 'idiopathic' malabsorption group of coeliac disease (which is hardly mentioned), idiopathic steatorrhea and tropical sprue or else to discuss the whole range of malabsorption disorders, including lymphomas, loop syndromes, Whipple's disease and so on.

There are two 'guest authors' from Britain, and these two present the most interesting chapters in the book. Margot Shiner discusses the new technique of jejunal biopsy, and Trevor Cooke the defects in water and electrolytes in idiopathic steatorrhea. The importance of potassium deficiency in causing the weight loss, change in bowel motility and tetany in this syndrome are of great interest. The chapter on pathological studies presents the interesting results of jejunal biopsy though there is unnecessary overlap between this chapter and that on the biopsy technique.

The section on treatment indicates clearly the place of steroid therapy in the sprue syndrome. Unfortunately the authors have had little experience of gluten-free diets. Treatment of the very troublesome symptom of tetany is nowhere properly described; a few tablets of calcium lactate alone are not likely to be very successful.

Despite the above rather carping criticism, there is obviously a need for a monograph on this topic, and the physician will find much of importance on all possible complications of the idiopathic malabsorption syndrome contained in it. The production and paper is excellent, although the index is very skimpy.

P.J.

BRONCHO-PULMONARY DISEASES

Bronchopulmonary Diseases—Basic Aspects, Diagnosis and Treatment. By 142 authors. Edited by Emil A. Naclerio, M.D. Pp. xxi + 956. 719 Illustrations. 24.00 dollars. New York: Paul B. Hoeber, Inc. 1957.

Contents: Section I. Embryology, Developmental, anomalies and Anatomy. Section II. Physiology and Pathology. Section III. Diagnosis. Section IV. Roentgenology. Section V. Heart and Lung Diseases. Section VI. Edema and Hemorrhage. Section VII. Embolism, Infarction and Thrombosis. Section VIII. Upper Respiratory Tract and Pulmonary Disease. Section IX. Cough. Section X. Bronchitis, Broncholithiasis and Bronchial Fistula. Section XI. Allergy. Section XII. Pulmonary Manifestations of Systemic Diseases. Section XIII. Congenital Diseases. Section XIV. Hernia (Pneumothorax) of the Lung. Section XV. The Pneumonias. Section XVI. Emphysema. Section XVII. Pneumoconiosis. Section XVIII. Pulmonary Mycoses. Section XIX. Parasitic Diseases. Section XX. Foreign Bodies. Section XXI. Atelectasis. Section XXII. Postoperative Pulmonary Complications. Section XXIII. Fundamental Considerations in Pulmonary Surgery. Section XXIV. Pulmonary Tuberculosis. Section XXV. Bronchiectasis, Abscess and Cystic Diseases. Section XXVI. Tumors, Benign, Malignant and Metastatic. Section XXVII. 'Coin' Lesions and Solitary Tumors. Section XXVIII. Traumatic, Chemical and Radiation Injury. Section XXIX. Pleuropulmonary Diseases. Section XXX. Preservation of Lung Tissue. Section XXXI. Fundamental Considerations in Management. Index.

This enormous volume with its multi-author contributions is the latest addition to the modern American trend in medical publication. The reviewer questions very seriously whether this is the best method of presentation of advances and modern up-to-date views of selected authorities in the varying fields of clinical medicine. It would seem that monographs on selected subjects serve the purpose much more fully. Understandably, where there are 142 authorities contributing there must be quite a variation in the style and quality of the articles. It is perfectly true that in this volume the subject of bronchopulmonary diseases is covered most fully and adequately and can certainly serve as a reference book to physicians and surgeons interested in Diseases of the Chest. There are some excellent articles on Pathology by David Spain, on Allergic Manifestations in the Respiratory Tract by Joseph Harkavy, and many good contributions in Radiology of the Chest and interpretations by many authorities. The sections on 'Coin' lesions and solitary tumors, as well as on tumors, bronchiectasis, abscess and cystic diseases are particularly informative. A feature of this volume is the excellent bibliography. It is however rather irritating to the reviewer to see such few references to British authors and experts in the field of bronchopulmonary diseases, authorities who in many cases have made such outstanding contributions to the knowledge and understanding of Diseases of the Chest, to say nothing of treatment both medical and surgical.

A theme that runs through most of the contributions is the increasing realization that for successful treatment in Diseases of the Chest close co-operation between the thoracic surgeon and the internist is required. Both must be open to suggestion and constructive criticism with a feeling of mutual respect for each other's opinions.

As with all Hoeber-Harper publications the paper, print and illustrations leave nothing to be desired.

The book is expensive and can have but a limited appeal to those interested in Chest Diseases.

A.L.

RADIOGRAPHICAL TECHNIQUE

Medizinische Röntgentechnik. Lehrbuch für medizinisch-technische Assistentinnen, Ärzte und Studierende. In Zwei Teilen. I. Medizinischer Teil: Skelettaufnahmen und Organuntersuchungen. Zweite, Erweiterte Auflage. Von Prof. Dr. H. Schoen. Bearbeitet von Dr. D. Schoen. viii + 347 Seiten. 534 Abbildungen. DM 29.70. (Mengenpreis ab 10 Expl. DM 26.70). (II. Physikalisch-technischer Teil 2. Auflage erscheint Anfang 1957). Stuttgart: Georg Thieme Verlag, 1957.

Inhaltsverzeichnis. Vorwort zur 2. Auflage. Vorwort zur 1. Auflage. Allgemeine Richtlinien. I. Skelett, Tränenwege, Kontrastdarstellung. II. Zähne. III. Darstellung der Gelenkhöhlen. IV. Weichteile. V. Vasographie. VI. Nasen-Rachen-Raum, Kehlkopf und Trachea. VII. Durchleuchtung. VIII. Herzuntersuchung. IX. Lungeneinstellungen. X. Verdauungstrakt. XI. Harnwege. XII. Männliche Genitalorgane. XIII. Geburtshilfe und Frauenheilkunde. XIV. Fisteldarstellung. XV. Myelographie. XVI. Encephalographie. XVII. Ventrikulographie. XVIII. Pneumoradiographie. XIX. Fremdkörperlokalisation. Übersicht der Kontrastmethoden. Verzeichnis der in Deutschland üblichen Röntgenkontrastmittel. Die wichtigsten Strahlenschutzregeln für die Röntgendiagnostik. Verzeichnis der Nachschlagwerke.

After a few pages of introduction, radiography of the extremities is fully described. A feature of this book is that each position shows

a photograph of the position on the patient, the same position on a skeleton and a photograph of the completed X-ray film.

No exposure factors are given, as the author explains in the foreword, due to the fact that so many different types of machines and film are available that it would be extremely difficult to give accurate exposure factors. Radiographic positions of the spinal column are well demonstrated and include oblique views of the cervical and dorsal spine.

All the usual positions of the skull, nasal sinuses, and teeth are fully shown and are easy to understand from the illustrations. The chapter on arthrography is extremely interesting. Arthrography of the temporo-mandibular joints, shoulder joints, and all the other major joints are described and very good X-ray photographs are demonstrated.

Discography (Nucleography) is fully explained and the technical details and various methods of vasography are described in great detail.

The chapter on the examination of the heart should be of particular interest to the radiographer, as the different positions for various pathological conditions are explained.

A chapter on the radiological examination of the lungs including bronchography is given. The chapter on the gastro-intestinal tract includes sections on cholangiography and cholecystography. Pyelography, obstetrical and gynaecological radiography are well demonstrated.

The book is written in an easy style and should be of value to both radiographers and radiologists.

H.C.P.

CLINIC FOR SPASTICS

Spastics in Cheyne Walk. Edited and compiled by Joan Saunders and Marjorie Napier. Pp. xiv + 156. Illustrated. 20s. net. London: Pitman Medical Publishing Co. Ltd. 1957.

Contents: Foreword. Editors' Note. Prologue. 1. The Little Hospital by the River. 2. The Planning of the Centre. 3. The Layout of the Centre. 4. A Day at the Centre. 5. What is Cerebral Palsy? 6. Cerebral Palsy Centres. 7. The Almoner. 8. The Clinical Psychologist. 9. The Physiotherapist. 10. The Speech Therapist. 11. The Occupational Therapist. 12. The School Teachers. 13. The House Mother. 14. The Secretary and her Assistant. 15. The Physician. Epilogue. Appendixes.

In a well-composed and well-edited booklet an account of a home for young spastic children under 5 years of age is given. Cheyne Walk Children's Hospital was erected in 1888 for the treatment of chronic disabilities. The hospital underwent a number of changes and its function as such came to an end during the last war when it was used as a day-nursery for the children of war workers. Its buildings suffered severely from bombing raids.

A description is given of the determined struggle to build up a suitable spastic clinic in recent years. In planning the centre, all possible facets of the problem have been thoroughly considered. It is interesting to notice with what care the establishment has been put together so as to produce an environment ideally suited to training the child to carry out all the acts of normal daily routine living. The contact with the parents is firmly established and they are made to feel, from an early stage, that the whole service is efficiently designed to train the children towards normality, as nearly as it can be obtained, in each particular case.

A sad note is struck by the fact that a certain amount of selection of cases, according to Intelligence Quotient assessments, must be made. This is economically understandable and is the inevitable problem faced by all such spastic clinics.

The wealth of important detail in respect of the layout of the centre and treatment of patients, which is arranged in ideal manner in this excellent book, would be of the greatest value to any unit contemplating building a similar spastic clinic almost anywhere in the world. The example and experience of Cheyne Walk should be a 'must' on the bookshelves of the members of such units.

C.E.L.A.

NA-OPERATIEWE KOMPLIKASIES

Die Postoperatiewe Fröhkomplikationen. Ihre Behandlung und Verhütung. Von Doz. Dr. K. Wiemers und Dr. E. Kern, mit einem Geleitwort von Prof. Dr. H. Krauss. xii + 264 Seiten, 52 Abbildungen in 69 Einzeldarstellungen, Gr. -8°, Ganzleinen DM 38. Stuttgart: Georg Thieme Verlag. 1957.

Inhaltsverzeichnis: Geleitwort. Vorwort. A. Zur Pathophysiologie der postoperativen Phase. B. Die speziellen postoperativen Fröhkomplikationen. C. Die Technik der notwendigen Maßnahmen. D. Literaturhinweise. E. Sachregister.

Hier is 'n boek van relatief klein formaat wat tog die hele veld van na-operatiewe komplikasies dek. Dit bevat genoeg besonderhede om volledig en goed verstaanbaar te wees. Die materiaal is duidelik en logies gerangskik.

In die eerste deel bespreek die skrywers die patologiese fisiologie van die na-operatiewe fase. Komplikasies van die asemhalingstelsel en sirkulasie sowel as vog- en elektrolietbalans word behandel. Laasgenoemde is saaklik en duidelik gestel. Hierdie eerste deel van die boek is baie waardevol veral met betrekking tot die dele wat volg, aangesien dit die fisiologie van die na-operatiewe periode, beklemtoon.

Onder die volgende hoof word die komplikasies van verskillende operasies bespreek bv. 'n thorakotomie, long- en hart-operasies. Sommige van die kleiner komplikasies na hart-operasies word nie genoem nie, maar die belangrikste is daar. Verder word die komplikasies wat volg op 'n laparotomie, operasies op die endokriene organe, bene en brein behandel. Die behandeling van tetanus en brandwonde word bespreek. Daar kan egter nie met die skrywers saamgestem word dat alleen brandwonde oor 20% in volwassenes en 15% in kinders as gevaarlik beskou moet word nie. 'n Nadeel is die afwesigheid van gegewens waarvolgens die vognamme per persentasie oppervlakte gebrand, uitgewerk kan word. Die laaste hoofstuk onder hierdie deel behandel die komplikasies wat volg op operasies op kinders, grysaaids en swanger vrouens. Ook in hierdie deel word die normale fisiologie telkens beklemtoon. Die derde afdeling gaan oor die metodes van behandeling van komplikasies. Die eenvoudiger spoed-eisende operasies soos bv. die behandeling van hartstilstand, word goed bespreek.

Dit is moontlik dat die skrywers in hierdie boek 'n té wye veld probeer dek. Sommige komplikasies word net in 'n paar sinne genoem sonder dat daar ruimte is om die oorsake en voorkoming daarvan te behandel. Tog sal hierdie boek van groot waarde wees vir na-graadse studente in chirurgie, en die algemene chirurg sal dit met genot lees. Net jammer dat dit in Duits is; indien hierdie boek in Engels was sou dit 'n baie waardevolle en gewilde boek vir Suid-Afrikaanse Chirurgie gewees het.

D.B.

PROGRESS IN GYNAECOLOGY

Progress in Gynecology. Volume III. By J. V. Meigs, M.D., and Somers H. Sturgis, M.D. Pp. xii + 780 Figs. \$15.50 New York and London: Grune and Stratton Inc. 1957.

Contents: Preface. Prefaces to Volumes I and II. I. Growth and Physiology. II. Diagnostic Methods. III. Functional Disorders. IV. Inter-Relationships of Endocrine Glands. V. Sterility and Reproduction. VI. Infections. VII. Benign Growths. VIII. Malignant Growths. IX. Operative Techniques. X. Preoperative and Postoperative Care. XI. Appendixes. XII. Index.

Volume I of this work appeared in 1946 and volume II in 1950. Meigs and Sturgis have edited all three volumes which have aimed at giving a survey of progress in the subject since World War II. Each volume deals with what were current advances at the time, the subsequent publications omitting the fundamental earlier contributions but adding what was new or in fulfilment of what had gone before.

Volume III shows an improvement on its predecessors and there is the promise that this publication will soon reach a high level of information and instruction for the expert rather than for the ordinary run of gynaecologist. The system is admirable, and the content is invaluable to the student of gynaecology. In volume III there are about 60 chapters, i.e. considerably less than in the other two. There is the point naturally that the editors decide which are the new concepts and facts that should be brought to the fore, and there the reader has to rely on them just as he has to do in respect of their choice of expert contributors. The matter is accordingly based on arbitrary thought. It has to be emphasized, however, that in addition to American authors there are several European and British authorities who contribute.

Meigs and Sturgis have made an undoubted contribution to gynaecology. This field is becoming consolidated and very much more important than obstetrics. It is, therefore, a matter of good fortune that there is now a publication on current advances in gynaecology uncomplicated by the subject of obstetrics. The reviewer hopes that the editors realise how important their future task is, and that they will feel justified in devoting even more to the project. To the gynaecologist at all stages of development these works are indispensable.

O.S.H.